United States Department of Agriculture

Forest Service

Pacific Northwest Region

June 2016

Green Mountain Project

Draft Environmental Impact Statement

McKenzie River Ranger District, Willamette National Forest
Lane County, Oregon

Legal Location: T16S R04E Sec: 36; T16S R05E Sec: 31-32; T17S R04E Sec: 1-2, 11-13, 24-25, 36; T17S R05E Sec: 5-10, 14-34; T17S R06E Sec: 19, 30; T18S R04E Sec: 1, 12; T18S R05E Sec: 1-30, 32-36; T18S R06E Sec: 6-8, 17-36; T18S R06½E Sec: 25-28, 31-35; T18S R07E Sec: 27-28, 31-35; T19S R05E Sec: 1-3, 11-15, 22-24; T19S R05½E Sec: 1-5, 8-17, 20-24, 27-28; T19S R06E Sec: 1-36; T19S R07E Sec: 2-11, 14-23, 27, 30-31; T20S R06E Sec: 1-3, 10-12; Willamette Meridian

Draft Environmental Impact Statement
Green Mountain Project
Willamette National Forest Service
Lane County, Oregon

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Abstract: This Draft Environmental Impact Statement (DEIS) contains the McKenzie River Ranger District's proposal to provide a sustainable supply of timber products, increase vegetative habitat complexity and hardwood composition along streams, shift age class, and improve structural diversity in 4,398 acres on the Willamette National Forest. The proposed project is located south of Highway 126, along Aufderheide Road, Forest Road 19, near the town of Blue River, Oregon. Three alternatives were analyzed in this DEIS; a no action alternative (Alternative 1) and two action alternatives (Alternative 2 and 3). Alternative 2 proposes 4,398 acres of treatment (including skips); Alternative 3 proposes 3,957 acres of treatment (including skips). Alternative 2 is the Forest Service preferred alternative. A one-time project specific Forest Plan Amendment would be required to implement either Alternative 2 or 3.

Comments: This DEIS is made available for a 45-day public comment period, under the provisions of the National Environmental Policy Act (40 CFR 1500-1508) and 36 CFR Part 218, which replaced Notice, Comment, and Appeal procedures at 36 CFR 215. The Forest Service will accept comments beginning on the day following the date of publication of the Notice of Availability (NOA) in the Federal Register. The official comment period timelines will be posted in a legal notice in Register Guard, and on the Willamette National Forest's Web site: http://www.fs.usda.gov/project/?project=40858

Submit comments electronically via the Forest Service online commenting system at:
https://cara.ecosystem-management.org/Public/CommentInput?project=40858

Or send comments to:
Elysia Retzlaff, NEPA Planner
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Reader's Guide

The Forest Service has prepared this Draft Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Draft Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed actions and alternatives. The document is organized as outlined below:

- *Summary*
- *Chapter 1. Purpose and Need:* This chapter describes the scope and objectives of the proposal as well as defines why the proposal is being made at this location and at this time.
- *Chapter 2.* This section describes the alternative methods for achieving the project's purpose. Alternatives are designed to meet the project's purpose and need and to address one or more significant issues related to the proposed actions. This chapter also includes mitigation measures and a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the environment that would be affected by the proposed actions as well as the environmental consequences of implementing the alternatives. The analysis is organized by resource area.
- *Chapter 4. List of Preparers:* This section lists the names, together with their qualifications (expertise, experience, professional disciplines), of the persons who were primarily responsible for preparing the environmental impact statement.
- *Chapter 5. List of Agencies, Organizations, and persons to whom copies of the statement are sent*
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the draft environmental impact statement.
- *References*
- *Glossary*
- *Index*

Additional documentation, including more detailed analysis of project area resources, can be found in the project planning record located at the McKenzie River Ranger District Office on the Willamette National Forest.

List of Acronyms

ACS..................Aquatic Conservation Strategy
AMA ....Adaptive Management Area
ARP..................Aggregate Recovery Percentage
B/C Ratio ....Benefit / Cost Ratio
BE ....Biological Evaluation
BLM.................Bureau Of land Management
BMP ....Best Management Practices
BO....................Biological Opinion
C:N...................Carbon:Nitrogen ratio
CFR..................Code of Federal Regulations
CH....................Critical Habitat
CWPP...............Community Wildland Protection Plan
DBH ....Diameter Breast Height (4.5 feet above ground)
DEIS.................Draft Environmental Impact Statement
DEQ ....Department of Environmental Quality
DNA.................Deoxyribose Nucleic Acid
DTR ....Dominant Tree Release
EFH..................Essential Fish Habitat
EIS ....Environmental Impact Statement
ESA..................Endangered Species Act
FEIS ....Final Environmental Impact Statement
FL.....................Flame Length
FM....................Fuel Model
FR.....................Fire Regime
FRCC ....Fire Regime Condition Class
FS ....Forest Service
FSH ....Forest Service Handbook
FSM ....Forest Service Manual
FSVeg...............Forest Service Vegetation database
FVS ....Forest Vegetation Simulation
GIS ....Geographic Information System
GPS ....Global Positioning System
HE ....Habitat Effectiveness
HH....................Harvest Habitat

HUC ....Hydrologic Unit Code
IRA...................Inventoried Roadless Area
LAA ....Likely to Adversely Affect
LMRP...............Land and Resource Management Plan
LSR ....Late Successional Reserve
LWM ....Large Woody Material
MA ....Management Allocation
MBF ....Thousand Board Feet
MIS ....Management Indicator Species
MMBF ....Million Board Feet
MNRT ....McKenzie National Recreation Trail
MSA ....Magnuson-Stevens Fishery Conservation and Management Act
MSNO ....Master Site Number
MVUM.............Motor Vehicle Use Map
NEPA ....National Environmental Policy Act
NFF ....National Forest Fund
NHPA ....National Historic Preservation Act
NLAA ....Not Likely to Adversely Affect
NMFS...............National Marine Fisheries Service
NOAA ....National Oceanic and Atmospheric Administration
NPV ....Net Present Value
NRHP...............National Register of Historic Places
NRIS ....Natural Resource Information System
NRT..................National Recreation Trail
NSO ....Northern Spotted Owl
NWFP ....Northwest Forest Plan
ODF ....Oregon Department of Forestry
OFRI ....Oregon Forest Resources Institute
OHV ....Off-Highway Vehicle
PETS ....Proposed Endangered Threatened and Sensitive species
PFMC...............Pacific Fishery Management Council
PNW.................Pacific Northwest
Q100 ....100 Year Flood Flows
ROD ....Record of Decision
ROS ....Rate Of Spread (Fire and Fuels)
ROS..................Recreation Opportunity Spectrum
SDI ....Stand Density Index

SDImax............Maximum Stand Density Index
SIA...................Special Interest Area
SMS ....Scenery Management System
TL.....................Tolerance Level
TMDL..............Total Maximum Daily Load
UMR ....Upper McKenzie River
USDA...............United States Department of Agriculture
USFWS............United States Fish and Wildlife Service
VMS.................Visual Management System
VQO.................Visual Quality Standard
WCS.................West Cascades South
WEPP...............Watershed Erosion Prediction Project model
WMU...............Wildlife Management Unit

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Table of Contents

Table of Figures

Table of Tables

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Summary

The McKenzie River Ranger District is proposing to provide a sustainable supply of timber products, increase vegetative habitat complexity and hardwood composition along streams, shift age class, and improve structural diversity in 4,398 acres on the Willamette National Forest. The proposed project is located off Highway 126, along Aufderheide Road (Forest Road 19), near the town of Blue River, Oregon.

Purpose and Need

Provide a Sustainable Supply of Timber Products

The proposed project is needed to ensure the Willamette National Forest continues to supply a reliable supply of timber products as directed by the laws and guidance discussed in Section 1.2 and in doing so contributes to the stability of local, regional, and national economies and achieves the annual Probable Sale Quantity (PSQ) target for the Forest.

Increase Vegetative Habitat Complexity and Hardwood Composition along Streams

The proposed project is needed to increase vegetative habitat complexity and hardwood composition along streams. Past logging practices and fire exclusion have resulted in dense, uniform species stands with few hardwood trees along riparian areas. As a result, these stands have low wildlife habitat complexity and low species diversity. The proposed project would help restore these stands to more desirable, healthy conditions by adding snags and down wood in and near streams and also increasing the amount of hardwood trees, shrubs, and forbs along streams to add both structural and species diversity.

Shift Age Class and Structural Diversity

The proposed project is needed to balance the age class and structural diversity in the proposed project area, providing benefits to vegetation, wildlife and overall health of the forest. The presence of all age classes, from the very young forests (0-20 years) to the very old forests (250+ years) is important for ecosystem health, ensuring that habitat needs of a multitude of plants and animals, is better situated to persist in the future despite uncertainties associated with climate change. The proposed project would help restore age class diversity with thinning, gap diversity, dominant tree release and skips.

Proposed Actions

Proposed harvest treatments include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Transportation related activities would include temporary road construction, road maintenance, road decommissioning, road storage, and bridge replacement.

Forest Plan Amendment (#58)

The proposed actions in Alternative 2 and 3 would include treatments in Management Area 5a – Special Interest Areas (SIAs). The Green Mountain project proposes to treat approximately 206 acres in the South Fork McKenzie SIA and approximately 59 acres in the Hidden Lake-Lulu Lake SIA with thinning, gaps, and skips.

No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline MA-5a-05: "*No programmed harvest shall be scheduled.*" However, Implementation Guides for SIAs include objectives and enhancement recommendations for managing second growth plantations to accelerate growth and more quickly attain attributes of older stands; implementing silvicultural treatments in stands where densities are high or showing a reduction of growth to improve tree and stand vigor; maintaining health and aesthetics while maintaining decadence of the forest in and around Hidden Lake area through harvest of even-aged, previously managed stands; and accelerating late successional characteristics in young stands to enhance connectivity corridor between Late Successional Reserves.

Treatments proposed in the SIAs would move stands towards achieving the objectives and enhancement recommendations listed above and described in further detail in the Implementation Guides. Because No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline 5a-05, a one-time exception approved with a Forest Plan amendment would be required with Alternative 2 or 3.

Alternatives

Three alternatives were analyzed in this DEIS; a no action alternative (Alternative 1) and two action alternatives (Alternative 2 and 3). The alternatives vary by the amount of treatment and the specific prescriptions to be implemented (Table 1). Alternative 2 is the proposed action and preferred alternative.

Table 1. Comparison of the Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Treatments				
Thinning outside Riparian Reserves	Acres	0	1,454	1,596
Thinning in Riparian Reserves	Acres	0	901	894
Regeneration Harvest	Acres	0	325	0
Gaps	Acres	0	320	261
Dominant Tree Release	Acres	0	291	206
Skips outside Riparian Reserves	Acres	0	346	253
Skips In Riparian Reserves	Acres	0	761	747
Total	**Acres**	**0**	**4,398**	**3,957**
Estimated Gross Volume	**MMBF**	**0**	**~89**	**~68**
Post-Harvest Fuels Treatments in Timber Harvest Units				
Pile and Burn (mechanical and/ or hand treatments)[1, 2]	Acres	0	2,496	2,575
Post-Harvest Underburn[1, 2]	Acres	0	795	382
Road Activities Associated with Harvest				

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
New Road Construction	Miles	0	0	0
Temporary Road Construction	Miles	0	10.3	8.6
Roads Maintained	Miles	0	130	115
Road Decommissioning	Miles	0	2	2
Road Storage	Miles	0	21.1	21.1
Seasonal Road Closure Removed	Miles	0	6	6
Seasonal Road Closure Changed to Permanent Road Closure	Miles	0	3	3
Bridge Replacement (Hardy Creek)	--	No	Yes	Yes
Rock obtained from expanding existing quarries	Cubic Yards	0	15,000	15,000
Acres by Harvest System				
Helicopter Harvest	Acres	0	90	90
Skyline Harvest	Acres	0	2,436	2,265
Ground-based Harvest	Acres	0	765	602
Harvest Associated Planting, Snags, and Down Wood				
Planting in Regeneration Harvest	Acres	0	325	0
Planting in Gaps	Acres	0	130	53
Natural Regeneration in Gaps	Acres	0	190	208
Snags and Down Wood (occurs in regeneration units)	Snags per acre and liner feet of large down wood of decay classes I-II	0	Retain or create up to 5 snags per acre and at least 240 linear feet of down wood on approximately 43 acres.	0
Northern Spotted Owl (NSO) Habitat				
NSO Suitable Habitat in Critical Habitat Treated	Acres	0	57	0
NSO Dispersal Habitat in Critical Habitat Treated	Acres	0	1,187	1,187
NSO Non-Habitat Habitat in Critical Habitat Treated	Acres	0	76	76

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
NSO Suitable Habitat Treated (including skips) [1]	Acres	0	411	0
NSO Dispersal Habitat Treated (including skips) [1]	Acres	0	3,287	3,287
NSO Non-Habitat Treated (including skips) [1]	Acres	0	592	592
Gap and Fall and Leave Treatments in Riparian Reserves				
¼ Acre Non-commercial Gaps in Primary Shade Zone[1]	Acres	0	3.5	3.5
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)[1]	Acres	0	4	4
Fall and Leave to Add Wood to Stream Channels	Miles	0	2.7	2.7
Forest Plan Amendment (#58)				
South Fork McKenzie River Special Interest Area[1]	-	No	Yes	Yes
Hidden Lake – Lulu Special Interest Area[1]	-	No	Yes	Yes

1 - These acres are already accounted for in the above table under “Timber Harvest Treatments” and therefore are not included in the total.

2 - Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device). Post-harvest fuels treatments methods may change depending on feasibility and funding.

Summary of Environmental Consequences

Table 2. Summary of Direct Environmental Consequences

Resource	Alternative 1	Alternative 2	Alternative 3
Forest and Stand Structure	Growth rates would continue to decline, and natural processes that affect tree vigor and cause changes in stand structure would continue. The effects of overstocked stands include decreased growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees harvested in the future would be reduced due to continued decline in diameter growth.	2,966 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth.	2,957 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth.
Fire and Fuels	No effect	Reduction of harvest created slash ≤3” diameter. This would improve firefighter and public safety during future wildfires, prepare units for planting, help to create snags, increase vegetation diversity to the project area and a secondary benefit of returning the natural disturbance process of fire.	Reduction of harvest created slash ≤3” diameter. This would improve firefighter and public safety during future wildfires, prepare units for planting, help to create snags, increase vegetation diversity to the project area and a secondary benefit of returning the natural disturbance process of fire.
Soil Productivity	No effect	Nutrient availability and compaction would remain within the limits outlined in the standard and guidelines of the Forest Plan	Nutrient availability and compaction would remain within the limits outlined in the standard and guidelines of the Forest Plan
Water Quality	No effect	Reduction in risk of sedimentation and road failures post-treatment. Benefit to long-term large woody debris and water temperatures. No measurable adverse effects to water quality	Reduction in risk of sedimentation and road failures post-treatment. Benefit to long-term large woody debris and water temperatures. No measurable adverse effects to water quality

Resource	Alternative 1	Alternative 2	Alternative 3
Rare Plants	No effect	No effect	No effect
Rare Fungi	No effect	Commercial harvest, broadcast burning, gaps, and regeneration harvest may impact fungi propagation.	Commercial harvest, broadcast burning, gaps, and regeneration harvest may impact fungi propagation.
Special Habitats	No effect	No effect	No effect
Invasive Plants	No effect	Potentially invasive habitat would occur on 75 acres due to temporary road construction.	Potentially invasive habitat would occur on 63 acres due to temporary road construction.
Roads	No change in the use pattern of roads or correction of existing road maintenance problems. Brush and tree re-growth and associated reduced visibility, debris on road, and surface irregularities from OHV and other traffic could eventually result in unsafe traveling conditions for public and administrative traffic, as well as increasing resource damage associated with localized erosion.	Would reverse declining road conditions on an estimated 130 miles of road. Would reduce the open road density by 26 miles leaving stored and decommissioned roads in a hydrologically stable condition reducing the miles of road maintenance and reducing the risk of sediment.	Would reverse declining road conditions on an estimated 115 miles of road. Would reduce the open road density by 26 miles leaving stored and decommissioned roads in a hydrologically stable condition reducing the miles of road maintenance and reducing the risk of sediment.
Air Quality	No effect	Effects on air quality from smoke emissions would not exceed state mandated policy.	Effects on air quality from smoke emissions would not exceed state mandated policy.
Heritage	No effect	Potential direct effects to potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey.	Potential direct effects to potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey.
Recreation	No effect. Potential benefits to scenic driving and dispersed camping due to improved road quality, opening closed roads and the replacement of the bridge on Forest Service Road 1980-204 would not occur.	Some indirect effects to developed and dispersed recreation sites and trails such as temporary increases in noise, dust and minor road delays may occur. Direct effects to trails will include loss of access to portions of trails during harvest activities and short	Moderately less indirect effects of noise, dust and road delays compared to Alternative 2 due to an overall reduction of harvest activity. No change in direct effects between Alternative 2 and 3.

Resource	Alternative 1	Alternative 2	Alternative 3
		term evidence of harvest activities adjacent to approximately 1.25mi of trails within the project area. No direct effects to developed sites or inventoried dispersed campsites would occur.	
Economics	No contribution to local economy, forest sector jobs, or the National Forest Fund (NFF) would result. If not replaced by another project, Alternative 1 could contribute to a continued decline in forestry and milling related jobs.	Approximately 89 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue and the National Forest Fund (NFF) would result. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.	Approximately 68 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue and the National Forest Fund (NFF) would result. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.
Inventoried Roadless Area	No effect	No effect	No effect
Wilderness	No effect	Temporary deterioration of air quality and noise during haul and harvest activity in units in close proximity to wilderness.	Temporary deterioration of air quality and noise during haul and harvest activity in units in close proximity to wilderness.
Unroaded Areas	No effect	Unroaded areas would be reduced by 2.3 percent	Unroaded areas would be reduced by 0.39 percent.
South Fork McKenzie Wild and Scenic Study River	No effect	No effect	No effect
South Fork McKenzie Special Interest Area	Growth rates would continue to decline, and natural processes that affect tree vigor and cause changes in stand structure would continue. The effects of overstocked stands include decreased growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The	206 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth.	206 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth.

Resource	Alternative 1	Alternative 2	Alternative 3
	product value of trees harvested in the future would be reduced due to continued decline in diameter growth.		
Lulu / Hidden Lake Special Interest Area	Growth rates would continue to decline, and natural processes that affect tree vigor and cause changes in stand structure would continue. The effects of overstocked stands include decreased growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees harvested in the future would be reduced due to continued decline in diameter growth.	59 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth.	59 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth.
Northern Spotted Owl **(Threatened and Management Indicator Species)**	No effect	Likely to Adversely Affect due to suitable habitat removal and noise disturbance. Not Likely to Adversely Affect due to removal of dispersal habitat	Likely to Adversely Affect due to noise disturbance. Not Likely to Adversely Affect due to removal of dispersal habitat
Northern Spotted Owl **(Critical Habitat)**	No effect	Likely to Adversely Affect due to downgrading of 57 acres of suitable habitat to dispersal habitat	May Affect, Not likely to Adversely Affect
American Peregrine Falcon **(R6 Sensitive and Management Indicator Species)**	No impact	No impact with seasonal restrictions applied	No impact with seasonal restrictions applied
Pacific Fisher **(ESA Proposed Threatened and R6 Sensitive)**	No Effect	No short-term effect with potential long-term beneficial impact. Fishers are unlikely to occur in the project area and the scale of the alternatives, which would impact between <1 percent to 8 percent of 3 hypothetical female home ranges, would not preclude them from reestablishing in the watershed, and effects	No short-term effect with potential long-term beneficial impact. Fishers are unlikely to occur in the project area and the scale of the alternatives, which would impact between <1 percent to 8 percent of 3 hypothetical female home ranges, would not preclude them from reestablishing in the watershed, and effects

Resource	Alternative 1	Alternative 2	Alternative 3
		to this species are unlikely to occur. In the long-term, potential Pacific Fisher habitat quality may benefit from year-round road closures, road storage and decommissioning, and possible large down wood enhancement.	to this species are unlikely to occur. In the long-term, potential Pacific Fisher habitat quality may benefit from year-round road closures, road storage and decommissioning, and possible large down wood enhancement. Impacts somewhat reduced compared to Alt. 2.
Fringed Myotis and Townsend's Big-eared Bat (R6 Sensitive)	No impact	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing.	No Impact
Johnson's Hairstreak (R6 Sensitive)	No impact	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing. Only a very small amount of western hemlock habitat would be affected by project activities and the Green Mountain Units currently have no identified dwarf mistletoe.	No Impact
Crater Lake Tightcoil (R6 Sensitive and Survey and Manage Species)	No impact	No impact because all suitable habitat would be protected with a minimum 10m no-harvest and no-burn buffer. Where suitable habitat would be impacted at the Hardy Creek bridge, presence does not occur.	No impact because all suitable habitat would be protected with a minimum 10m no-harvest and no-burn buffer. Where suitable habitat would be impacted at the Hardy Creek bridge, presence does not occur.
Cascades Axetail Slug (R6 Sensitive)	No impact	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing.	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing.
Oregon Megomphix (Survey and Manage Species)	No impact	May impact suitable habitat on about 2,651 acres	May impact suitable habitat on about 2,231 acres
Red Tree Vole (Survey and Manage Species)	No impact	Would remove or thin about 447 acres of higher quality habitat in stands over 80 years of age. May impact about 2,915 acres of lower quality habitat. No impact to documented nest areas.	No impact to higher quality habitat. May impact about 2,987 acres of lower quality habitat.

Resource	Alternative 1	Alternative 2	Alternative 3
Great Gray Owl (Survey and Manage Species)	No impact	May impact suitable habitat. Harvest treatments would create about 935 acres of open foraging habitat.	No impact to suitable habitat. Harvest treatments would create about 467 acres of open foraging habitat.
Cavity Excavators (Management Indicator Species)	No impact	Snag abundance may initially decline on 3,292 acres but may increase with post-harvest mitigation and enhancement	Snag abundance may initially decline on 3,973 acres but may increase with post-harvest mitigation and enhancement
Elk and Deer (Management Indicator Species)	No impact	Regeneration harvest and small gaps should increase elk forage quality from "poor" to "higher-marginal" for about 20 years on approximately935 acres. Thinning would improve forage on approximately 2,357 acres.	Regeneration harvest and small gaps should increase elk forage quality from "poor" to "higher-marginal" for about 20 years on approximately 467 acres. Thinning would improve forage on approximately 2,491 acres.
Pileated Woodpecker (Management Indicator Species)	No impact	approximately 446 acres of older forest stands over 80 years would be degraded	No impact
Marten (Management Indicator Species)	No impact	Degrades approximately 236 acres of marten habitat in the preferred montane forest habitat type	No impact
Bald Eagle (Management Indicator Species)	No impact	No impact	No impact
Northern Goshawk (Landbirds preferring older forest habitat)	No impact	Removal of approximately 86 acres of habitat between 80-135 years of age, and thins approximately 360 acres between 80-144 years of age, which has the preferred forest habitat structure	No impact
Rufous Hummingbird, Purple Finch (Landbirds favoring shrub habitat in early seral conifer stands)	No impact	Creates approximately 935 acres of complex early seral habitat lasting about 20 years	Creates approximately 467 acres of complex early seral habitat lasting about 20 years
Olive-sided Flycatcher (Landbirds favoring forest openings with large snags)	No impact	Harvest treatments would create approximately 935 acres of complex early seral habitat lasting about 20 years, with planned snag mitigation and enhancement for nest sites at the rate of 0-5/acre	Harvest treatments would create approximately 467 acres of complex early seral habitat lasting about 20 years, with planned snag mitigation and enhancement for nest sites at the rate of 0-5/acre

Resource	Alternative 1	Alternative 2	Alternative 3
Upper Willamette River Chinook Salmon (Evolutionarily Significant Unit)	No effect	May Affect, Likely to Adversely Affect. This effects determination is due to the potential for incidental take.	May Affect, Likely to Adversely Affect. This determination is due to the potential for incidental take.
Upper Willamette River Chinook Salmon (Critical Habitat)	No effect	May Affect, Not Likely to Adversely Affect. There would be no adverse modification to critical habitat. Critical habitat would be enhanced by fall and leave projects in Elk Creek.	May Affect, Not Likely to Adversely Affect. There would be no adverse modification to critical habitat. Critical habitat would be enhanced by fall and leave projects in Elk Creek.
Upper Willamette River Chinook Salmon (Essential Habitat)	No effect	Will Not Adversely Affect because of the no cut buffers established along fish bearing streams, project design measures, and the implementation of Best Management Practices (BMPs).	Will Not Adversely Affect because of the no cut buffers established along fish bearing streams, project design measures, and the implementation of Best Management Practices (BMPs).
Bull Trout (Distinct Population Segment)	No effect	May Affect, Likely to Adversely Affect. This effects determination is due to the potential for incidental take.	May Affect, Likely to Adversely Affect. This effects determination is due to the potential for incidental take.
Bull Trout (Critical Habitat)	No effect	May Affect, Not Likely to Adversely Affect. There would be no adverse modification to critical habitat. This is due to no cut buffers established along fish bearing streams,	May Affect, Not Likely to Adversely Affect. There would be no adverse modification to critical habitat. This is due to no cut buffers established along fish bearing streams,
Rhyacophila chandleri (Caddisfly)	No impact	The biological evaluation found that the Green Mountain Project may have beneficial impacts to this species. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.	The biological evaluation found that the Green Mountain Project may have beneficial impacts to this species. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.
Rhyacophila leechi (Caddisfly)	No impact	The biological evaluation found that the Green Mountain Project may have beneficial impacts to this species. This is due to an	The biological evaluation found that the Green Mountain Project may have beneficial impacts to this species. This is due to an

Resource	Alternative 1	Alternative 2	Alternative 3
		improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.	improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.
Namamyia plutonis (Caddisfly)	No impact	The biological evaluation found that the Green Mountain Project may have beneficial impacts to this species. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.	The biological evaluation found that the Green Mountain Project may have beneficial impacts to this species. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.

Chapter 1 - Purpose and Need

1.1 Introduction

The McKenzie River Ranger District is proposing to provide a sustainable supply of timber products, increase vegetative habitat complexity and hardwood composition along streams, shift age class, and improve structural diversity in 4,398 acres on the Willamette National Forest.

The project area encompasses 99,051 acres along Aufderheide Roade (Forest Road 19), near the community of Blue, River Oregon (Figure 1 and 2). The project is located in the South Fork McKenzie River-Cougar Reservoir; Rebel Creek; Augusta Creek; Roaring River; and Elk Creek-McKenzie River 6th field watersheds (Figure 3).

96,566 acres in the project area are managed by the Willamette National Forest with the remaining 2,485 acres managed by private industrial timber companies. The project area is composed mostly of a Douglas-fir and western hemlock overstory with an understory shrub component of vine maple, salal, dwarf Oregon grape, sword fern and Pacific rhododendron. There is a transition to the true fir/mountain hemlock zone above approximately 4,000 feet, most notably in the area east of Box Canyon.

Fire has been a dominant disturbance in the project area. Records indicate 316 fires occurred in the Green Mountain project area from 1970-2013. However, due to fire suppression most fires were suppressed at less than five acres within a few days of ignition. Timber harvest, including thinning, partial cut, and regeneration harvest has been the dominant disturbance in the project area over the last 100 years.

The project area is popular for several recreational activities including camping, hiking, horseback riding, fishing, bicycling, picnicking, berry picking, mushroom harvesting, scenic driving, and soaking in hot springs. Numerous developed recreation facilities including campgrounds, day use areas, boat launches and rental cabins provide a wide array of developed recreation options for visitors. An extensive trail system in the area supports a range of trail oriented activities including multi-day backpacking trips, day hiking, horseback riding, mountain biking, and access to the Three Sisters Wilderness. Forest Road 19, also known as the Robert Aufderheide Memorial Drive, is the primary road in the project area and is a designated portion of the West Cascades National Scenic Byway. The South Fork of the McKenzie River runs through the project area. A 25.7 mile portion of the South Fork of the McKenzie is a designated as a National Study Wild and Scenic River.

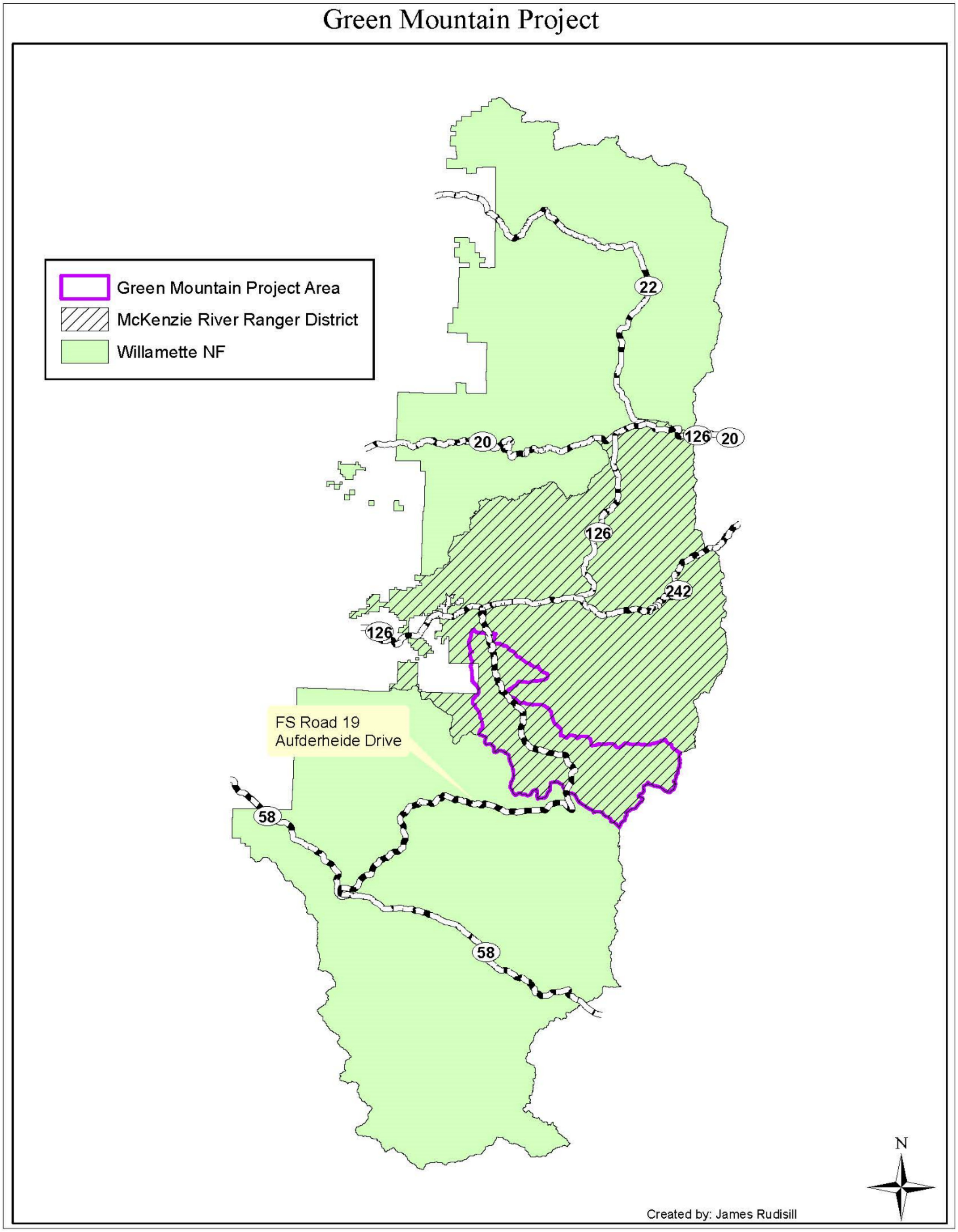


Figure 1. Green Mountain Vicinity Map

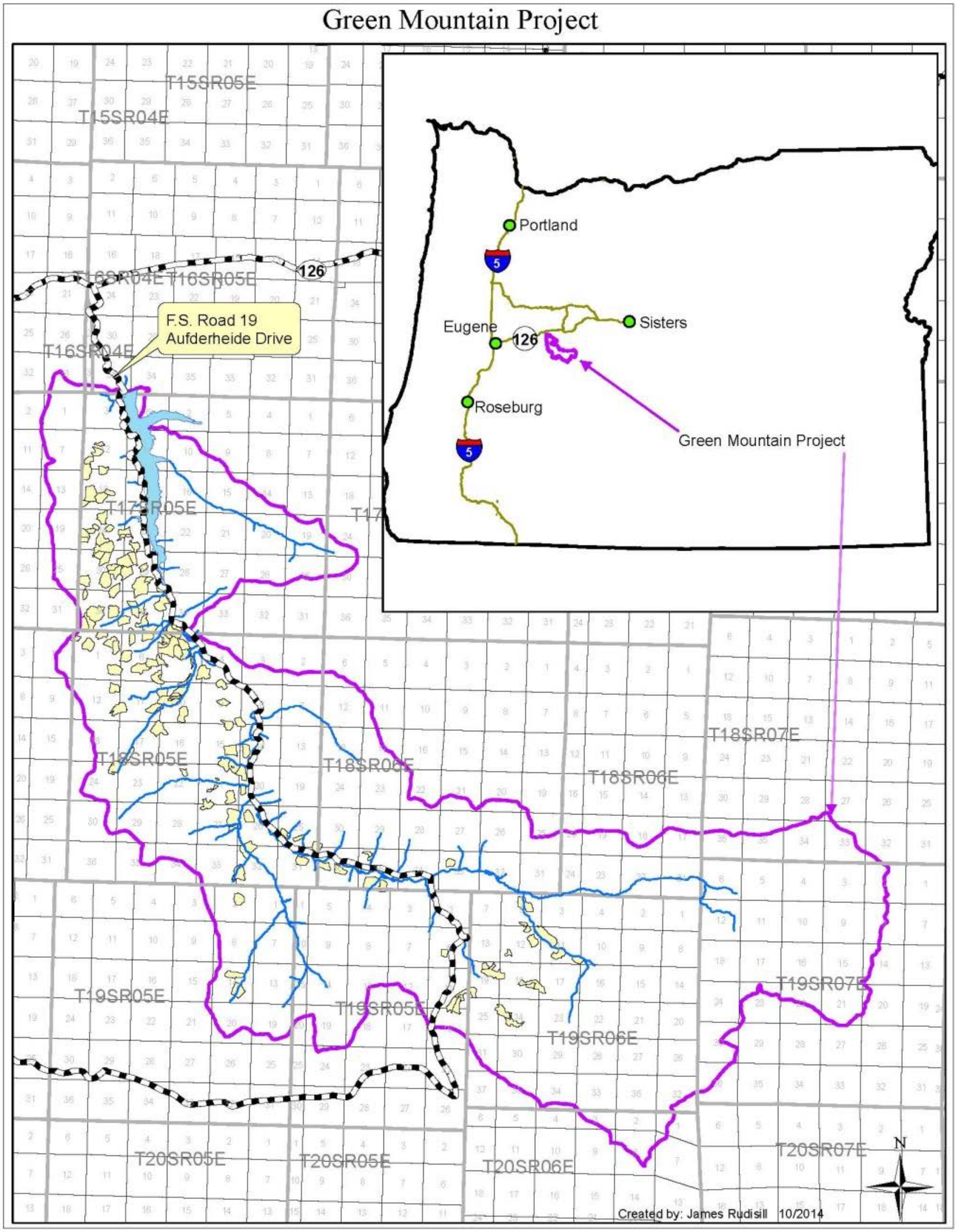


Figure 2. Green Mountain Project Area

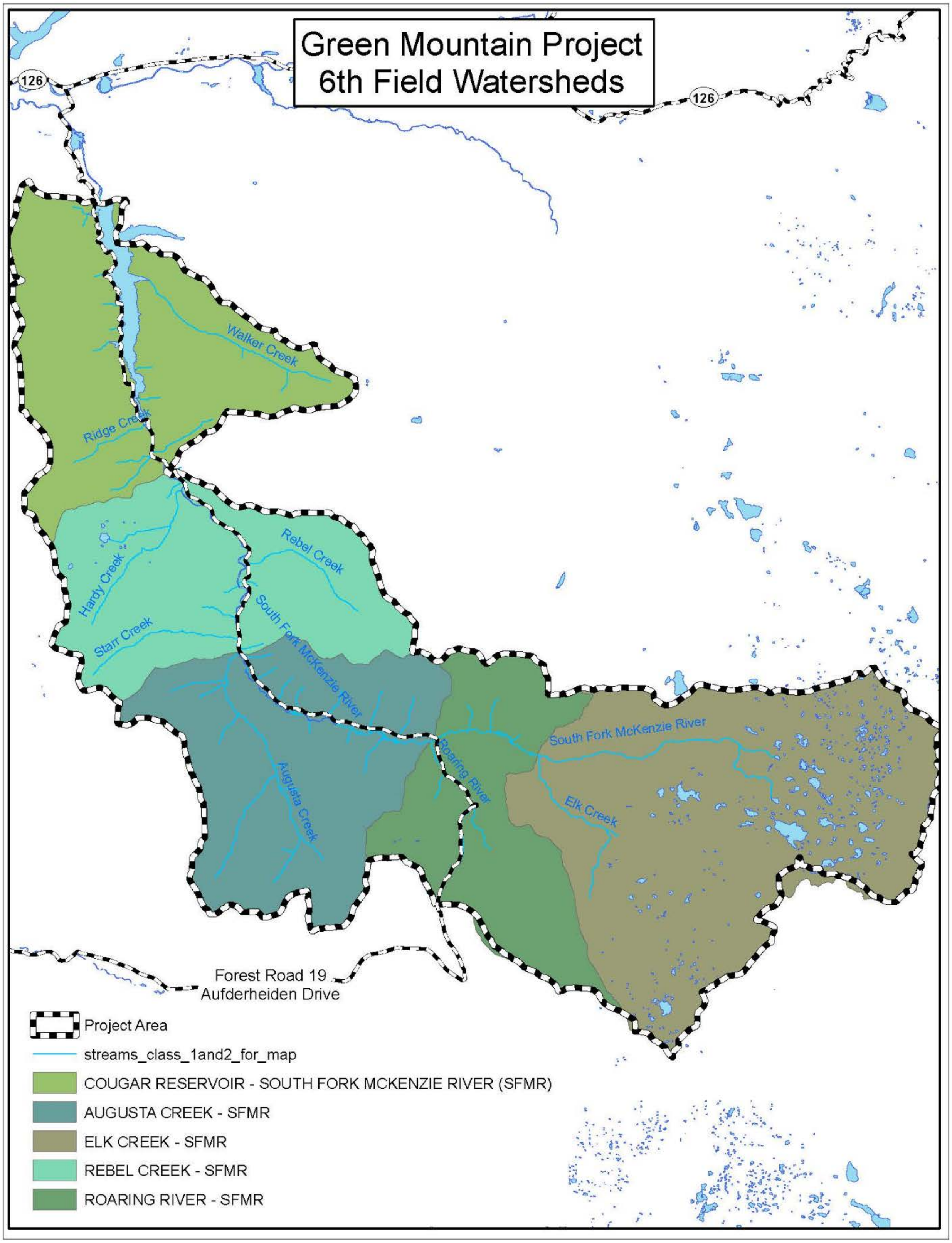


Figure 3. 6th Field Watersheds within the Green Mountain Project Area

1.2 Purpose and Need for the Action

Provide a Sustainable Supply of Timber Products

Why Consider Taking Action: The proposed project is needed to ensure the Willamette National Forest continues to supply a reliable supply of timber products as directed by the laws and guidance below and in doing so contributes to the stability of local, regional, and national economies and achieves the annual Probable Sale Quantity (PSQ) target for the Forest.

Several laws direct and allow the Forest Service to provide the sustainable harvest of trees from the Nation's forests including Multiple-Use Sustained-Yield Act of 1960 and the National Forest Management Act of 1976. One of the strategic goals of the Forest Service is to provide and sustain benefits to the people of the United States and the world as a whole. To accomplish this goal, one of the objectives is to provide a reliable supply of forest products over time consistent with achieving the desired conditions on National Forest System (NFS) lands and to maintain or create processing capacity and infrastructure in local communities. (USDA Strategic Plan FY 2014-2018). Additionally, the Willamette National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan, includes goals to produce an optimum and sustainable yield of timber that helps maintain the stability of local and regional economies, and contribute valuable resources to the national economy on a predictable and long-term basis.

Probable Sale Quantity (PSQ) is an estimate of probable harvest levels that could be maintained on a forest annually (Northwest Forest Plan 1994). PSQs represent neither minimum levels that must be met nor maximum levels that cannot be exceeded. Rather, PSQs represent the best assessment of the average annual amount of timber harvest that could occur on a forest without decline, over the long term, if the schedule of harvests and regeneration are followed (Northwest Forest Plan 1994). PSQ can vary and change over time depending on acres available for harvest, expected acre yields and Forest direction.

Existing Condition: The current PSQ annual target for the Willamette National Forest is 111 million board feet (MMBF) as amended by the Approval of PSQ Estimates for Northwest Forest Plan Forests (1998).

Desired Condition: Through implementation of the proposed actions, the McKenzie River Ranger District would contribute approximately 66 MMBF to the Willamette National Forest PSQ target over a four year period (approximately 16-17 MMBF/year).

Increase Vegetative Habitat Complexity and Hardwood Composition along Streams

Why Consider Taking Action: The proposed project is needed to help restore the vegetative habitat complexity and hardwood composition along streams, while providing secondary benefits to wildlife and fisheries with improved habitat in second growth stands and previously managed stands.

According to the NW Forest Plan, the Aquatic Conservation Strategy (ACS) "must strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitats. This approach seeks to prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds" (NW Forest Plan, p. B-9).

ACS objective (#8) specifically identifies maintaining and restoring the species composition and structural diversity of plant communities in riparian areas to provide thermal regulation, nutrient filtering, appropriate rates of erosion and channel migration, and to supply coarse woody debris (downed wood) sufficient to sustain physical complexity and stability (NW Forest Plan, p. B-11).

Existing Condition: Past logging practices and fire exclusion have resulted in dense, uniform species stands with few hardwood trees or understory shrubs throughout Riparian Reserves. As a result, these stands have low wildlife habitat complexity and low species diversity.

Desired Condition: The desired condition within Riparian Reserves includes: large conifers (Northwest Forest Plan, p. 31); complex habitat structure representative of that which would result from natural disturbance patterns; diverse species composition; snags and logs on the forest floor (Northwest Forest Plan, p. B-2); and future large wood for streams. The proposed project would help restore these stands to more desirable, healthy conditions by adding snags and down wood in and near streams while also increasing the amount of hardwood trees, shrubs and forbs along streams to add both structural and species diversity. Managing for hardwoods would also increase the diversity of the leaf litter in streams adding to the amount of nutrients available to aquatic insects. The treatments proposed along the streams would increase dynamic fish habitat which are important contributors to thriving populations. Additionally, improving existing roads and making them hydrologically stable would reduce sediment delivery to streams and improve their health.

Shift Age Class and Structural Diversity

Why Consider Taking Action: Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements, whereas other species thrive in middle age or old forests. Early seral habitat (defined here as less than 15 years old to represent grass/forb thru sapling/pole habitat) is of key importance to an estimated 165 to 198 species of wildlife in the Westside/Montane Forests of Oregon and Washington (Johnson D.H, O'Neil T.A., 2001, p. 194).

Historically, early seral habitat in the project area was created from stand-replacing fires and regeneration harvest. Changes in forest management on Federal lands in the past 30 years, including fire suppression and reduced regeneration harvest have resulted in fewer acres of early seral habitat creation. Additionally, fire suppression (removing stand and non-stand replacing fires) and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and diverse quality early seral habitat in the project area than in the past. Currently, early seral habitat within the Green Mountain project area is only partially effective (marginal) at providing quality diverse early seral habitat due to the lack of vertical and horizontal stand structure.

The proposed project is needed to balance the age class and structural diversity in the proposed project area, providing benefits to vegetation, wildlife and overall health of the forest. The presence of all age classes, from the very young forests (0-15 years) to the very old forests (250+ years) is important for ecosystem health, ensuring that habitat needs of a multitude of plants and animals, is better situated to persist in the future despite uncertainties associated with climate change. The proposed project would help restore age class diversity with thinning, gap diversity, dominant tree release and skips.

Existing Condition: Approximately 80 acres or 0.09 percent of the land managed by the Forest Service within the Green Mountain project area is 0-15 years of age.

Desired Condition: Increase early seral habitat to approximately seven percent in the project area. Swanson (2012, pg. 4) stated that at any point in time, a given landscape would be composed of 5-20 percent early seral habitat. The historic forest age-class distribution, derived from *A Landscape Plan Based on Historical Fire Regimes for a Managed Forest Ecosystem: the Augusta Creek Study* (USDA

1998), states that approximately seven percent of the Green Mountain project would historically be in young, 0-15 year old stands. Figure 4 shows the current age class distribution compared to the historic age distribution in Figure 5.

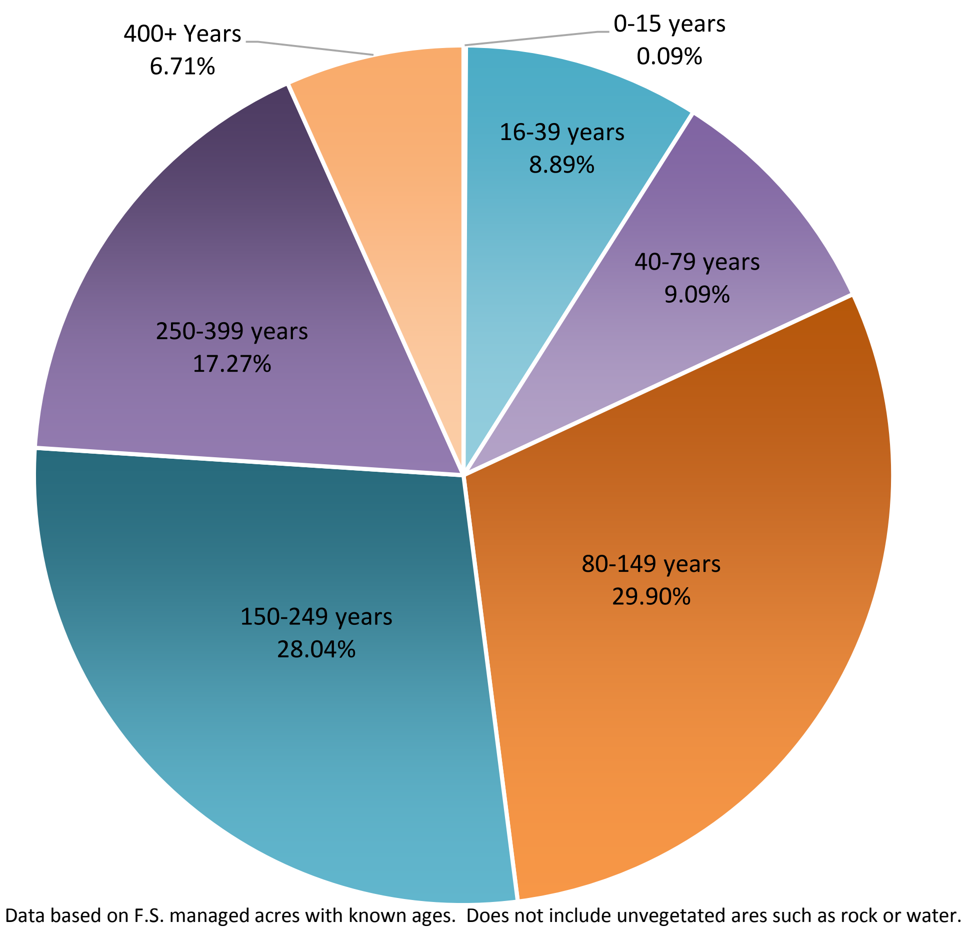
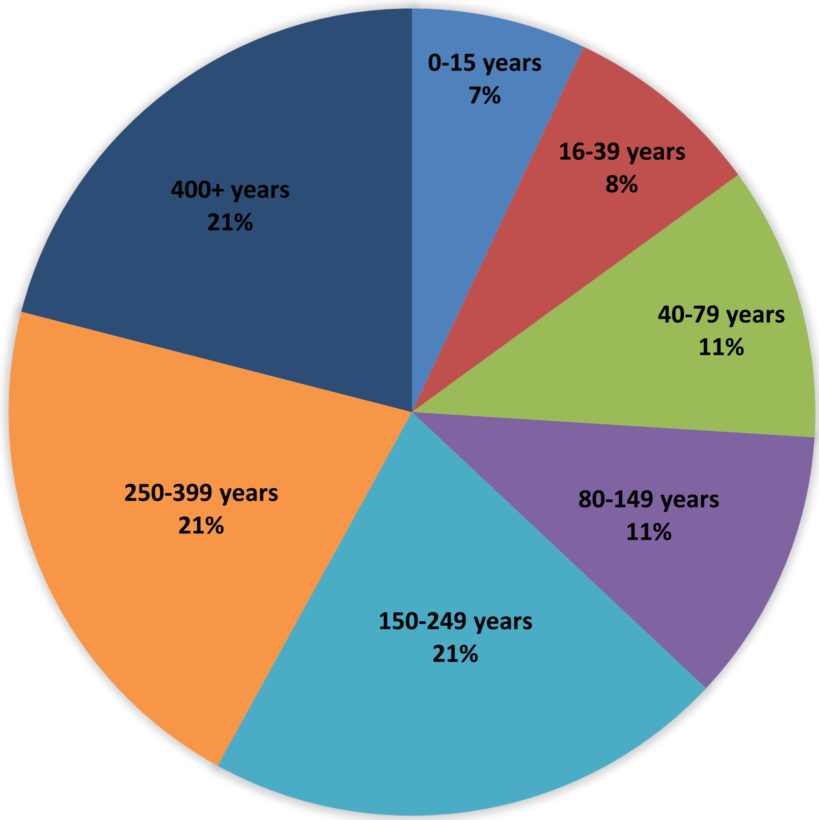


Figure 4. Current Age Class Distribution in the Green Mountain Project



Historic conditions based on the Augusta Creek Study of 1998

Figure 5. Historic Age Class Distribution in the Green Mountain Project

1.3 Proposed Actions

Proposed harvest treatments include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Transportation related activities would include temporary road construction, road maintenance, road decommissioning, road storage, and bridge replacement.

Forest Plan Amendment (#58)

The proposed actions in Alternative 2 and 3 would include treatments in Management Area 5a – Special Interest Areas (SIAs). The Green Mountain project proposes to treat approximately 206 acres in the South Fork McKenzie SIA and approximately 59 acres in the Hidden Lake-Lulu Lake SIA with thinning, gaps, and skips.

No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline MA-5a-05: "*No programmed harvest shall be scheduled.*" However, Implementation Guides for SIAs include objectives and enhancement recommendations for managing second growth plantations to accelerate growth and more quickly attain attributes of older stands; implementing silvicultural treatments in stands where densities are high or showing a reduction of growth to improve tree and stand vigor; maintaining health and aesthetics while maintaining decadence of the forest in and around Hidden Lake area through harvest of even-aged, previously managed stands; and accelerating late successional characteristics in young stands to enhance connectivity corridor between Late Successional Reserves.

Treatments proposed in the SIAs would move stands towards achieving the objectives and enhancement recommendations listed above and described in further detail in the Implementation Guides. Because No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline 5a-05, a one-time exception approved with a non-significant Forest Plan amendment would be required with Alternative 2 or 3. Please refer to Section 3.14 for additional information on the proposed Forest Plan amendment.

A detailed description of the actions proposed under each alternatives are included in Chapter 2. A detailed description of proposed treatments and project activities is located in Appendix B.

1.4 Forest Plan and Management Direction

This draft environmental impact statement is tiered to the following environmental impact statements and plans, which are incorporated by reference:

- The Willamette National Forest Land and Resource Management Plan Final Environmental Impact Statement, as amended (USDA Forest Service 1990; referred to as the “Forest Plan” and “LRMP”)
- The Forest Plan, as amended by the Northwest Forest Plan and Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species with the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management 1994a; referred to as the “Northwest Forest Plan”)
- The Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA Forest Service and USDI Bureau of Land Management 2001)
- The Final Environmental Impact Statement and Record of Decision for Preventing and Managing Invasive Plants (USDA Forest Service 2005).

The Forest Plan “guides all natural resource management activities and establishes management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resources management” (Forest Plan, I-1). The Forest Plan provides management direction through the designation of specific management areas and standards and guidelines specific to these designations.

The Forest Plan was amended by the Northwest Forest Plan (1994), which established additional management areas, standards, and guidelines associated with Matrix, Riparian Reserves, Adaptive Management Areas, and Late-Successional Reserves. When there is overlap of management areas, the more restrictive standards and guidelines apply (Northwest Forest Plan 1994a p. A-6). Figure 6 and 7 illustrate the Forest Plan and Northwest Forest Plan management areas. Table 3 displays Forest Plan management areas, Northwest Forest Plan land management areas and unit acres for the alternatives.

The following management direction is relevant to management allocations with proposed treatments in the project area:

Forest Plan

Special Interest Areas (5a) within the project area that have proposed treatments include the South Fork McKenzie Special Interest Area and the Hidden/Lulu Lake Special Interest Area. The purpose of Special Interest Area is to preserve lands that contain exceptional scenic, cultural, biological, geological, or other unusual characteristics. Timber management may not be implemented for the purpose of programmed harvests, but it may be implemented for treatments that maintain or enhance the values identified in the Implementation Guides for these areas.

Wildlife Habitat-Special Areas (9d) are areas allocated the goal of protecting or enhancing unique wildlife habitats and botanical sites which are important components of healthy, biologically diverse ecosystems. Timber management may not be implemented for the purpose of programmed harvests, but it may be implemented for treatments if necessary to meet established wildlife objectives.

Scenic-Modification Middleground (11a) are areas have the goal to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a modest level of scenic quality. These areas are also managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic-Partial Retention Middleground (11c) are areas that have the objective to **c**reate and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a moderate level of scenic quality. This area will also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic-Partial Retention Foreground (11d) are areas that have the objective to **c**reate and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a moderate level of scenic quality. This area will also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic Retention Foreground (11f) are areas that have the objective to **c**reate and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a high level of scenic quality. This area will also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Northwest Forest Plan

General Forest-Matrix Lands (MA 14a) consist of areas outside of other NWFP land allocation categories where most of the timber treatments occur to produce an optimum and sustainable yield of timber production that is compatible with multiple use objectives.

Riparian Reserves (MA 15) are areas where the conservation of aquatic and riparian-dependent, terrestrial resources receives primary emphasis. In these areas all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas are included and managed for the purpose of protecting the health of the aquatic system and its dependent species.

Adaptive Management Areas (MA 17) are areas designed to develop and test new management approaches to integrate and achieve ecological, economic, and other social and community objectives.

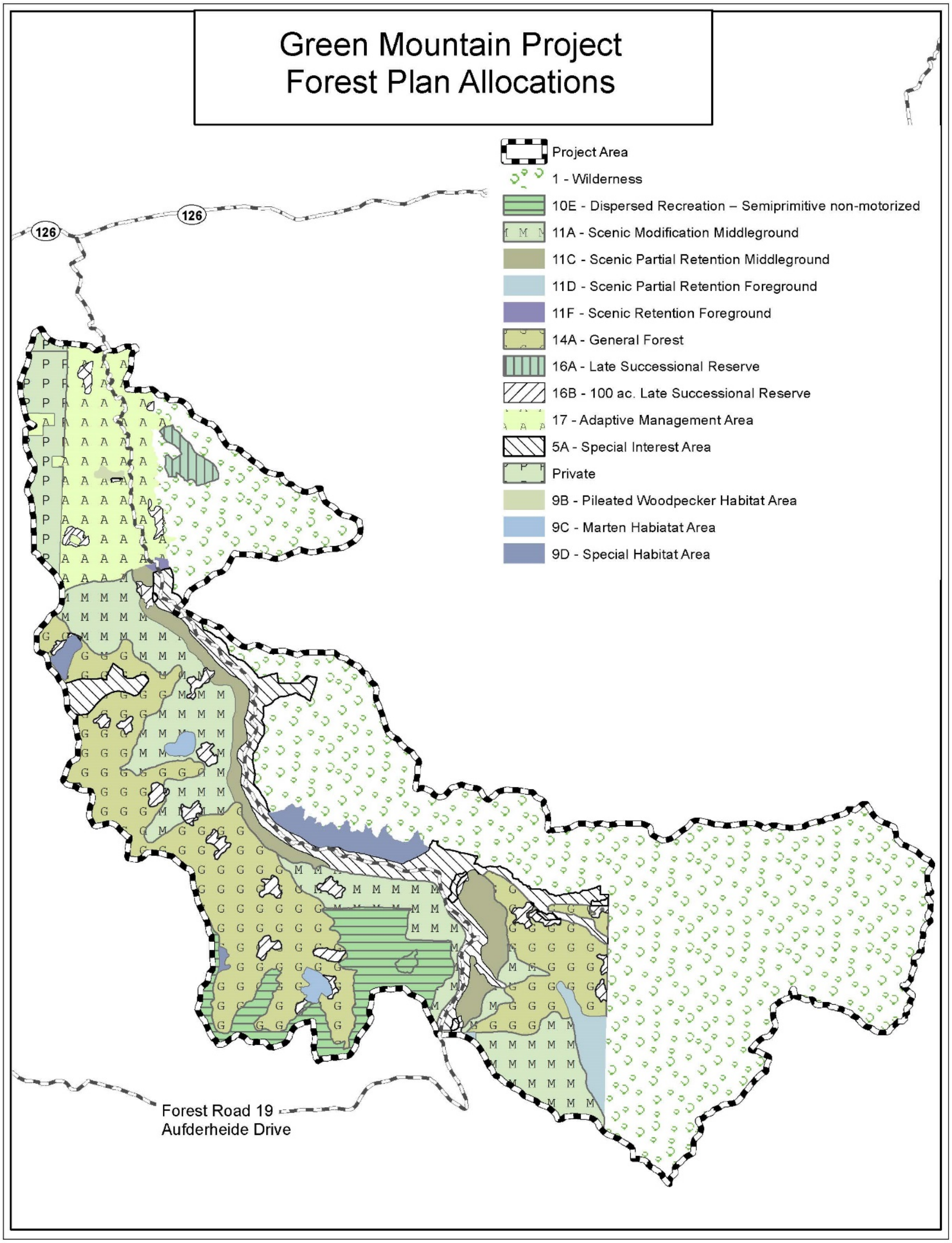


Figure 6. Forest Plan Management Allocations

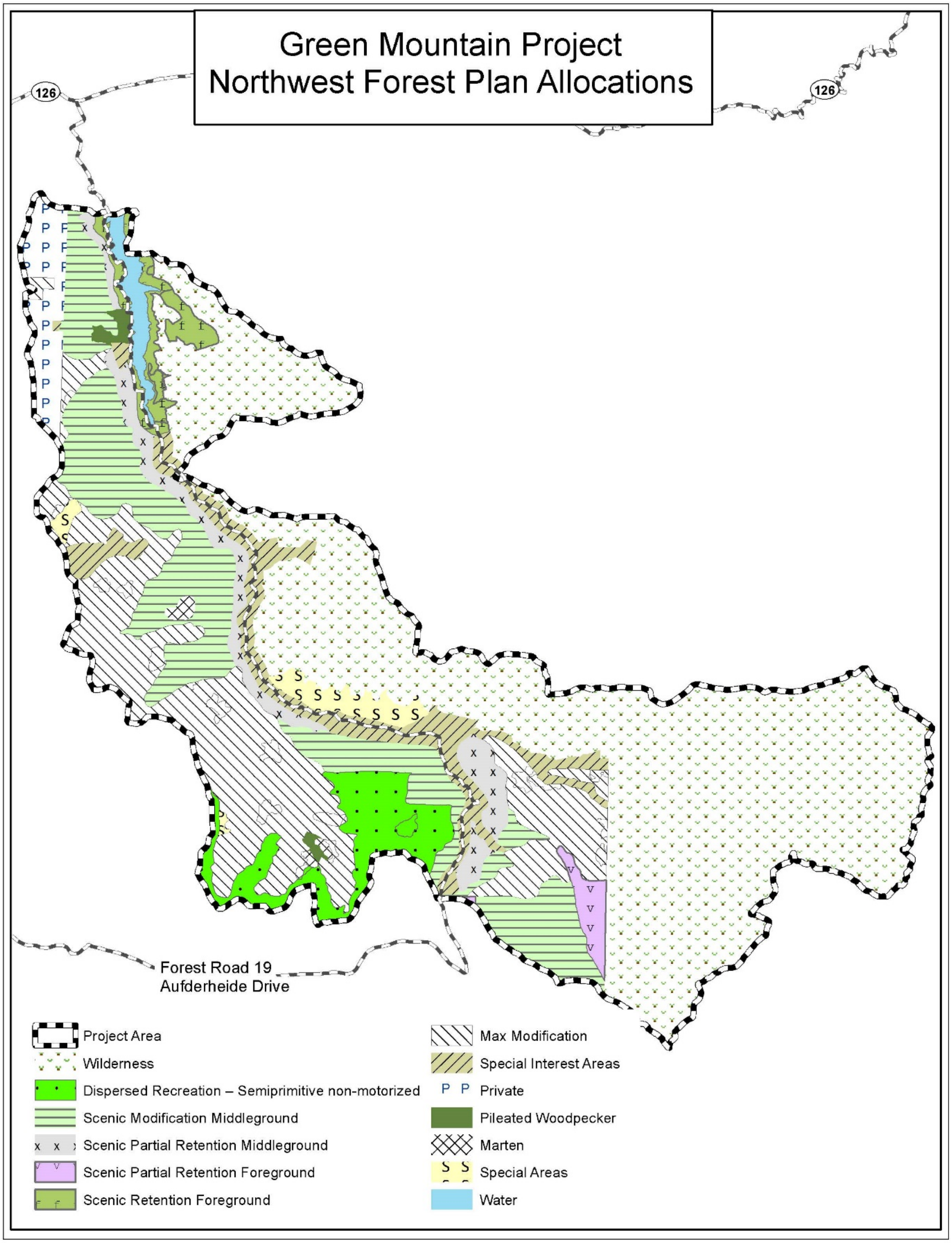


Figure 7. Northwest Forest Plan Management Allocations

Table 3. Management Allocations

Forest Plan Management Areas (MA)	Northwest Forest Plan Management Areas (MA)	Acres in Project Area	Acres of Treatment Alternative 2	Acres of Treatment Alternative 3
Wilderness (1)		44,909	0	0
Special Interest Areas (5A)	Matrix (14)	5,558	265	265
Special Interest Areas (5A)	100-acre Late Successional Reserve (16B)	185	0	0
Special Interest Areas (5A)	Adaptive Management Reserve (17)	139	0	0
Pileated Woodpecker (9B)		111	0	0
Pileated Woodpecker (9B)	100-acre Late Successional Reserve (16B)	92	0	0
Pileated Woodpecker (9B)	Adaptive Management Reserve (17)	191	0	0
Marten (9C)		169	0	0
Marten (9C)	100-acre Late Successional Reserve (16B)	116	0	0
Special Areas (9D)		1,327	0	0
Special Areas (9D)	100-acre Late Successional Reserve (16B)	148	73	73
Dispersed Recreation – Semiprimitive non-motorized (10E)	Matrix (14)	4,309	0	0
Dispersed Recreation – Semiprimitive non-motorized (10E)	100-acre Late Successional Reserve (16B)	120	0	0
Scenic Modification Middleground (11A)	Matrix (14)	11,062	1,387	1,245
Scenic Modification Middleground (11A)	100-acre Late Successional Reserve (16B)	578	0	0
Scenic Modification Middleground (11A)	Adaptive Management Reserve (17)	2,975	788	755
Scenic Partial Retention Middleground (11C)	Matrix (14)	2,800	541	426
Scenic Partial Retention Middleground (11C)	100-acre Late Successional Reserve (16B)	177	0	0
Scenic Partial Retention Middleground (11C)	Adaptive Management Reserve (17)	684	151	151
Scenic Partial Retention Foreground (11D)	Matrix (14)	889	3	0
Scenic Partial Retention Foreground (11D)	100-acre Late Successional Reserve (16B)	2	0	0
Scenic Retention Foreground (11F)	Matrix (14)	71	3	3
Scenic Retention Foreground (11F)	Late Successional Reserve (16A)	547	0	0
Scenic Retention Foreground (11F)	100-acre Late Successional Reserve (16B)	117	0	0

Forest Plan Management Areas (MA)	Northwest Forest Plan Management Areas (MA)	Acres in Project Area	Acres of Treatment Alternative 2	Acres of Treatment Alternative 3
Scenic Retention Foreground (11F)	Adaptive Management Reserve (17)	1,264	19	19
Max Modification (14A)	Matrix (14)	15,325	1,019	871
Max Modification (14A)	100-acre Late Successional Reserve (16B)	1,125	0	0
Max Modification (14A)	Adaptive Management Reserve (17)	615	152	149
	Riparian Reserves (15)[1]	48,979	1,786	1,764
Water (Cougar Reservoir)	Adaptive Management Reserve (17)	961	0	0
Private Land		2,485	0	0
Total Land Allocations		**99,051**	**4,398**	**3,957**

1 – Riparian Reserves overlay other land allocations and are therefore not included in the Total Land Allocations

1.5 Tribal Consultation

Tribal consultation for the Green Mountain project began in 2011, where it was presented at annual and individual Tribal meetings including the Klamath Tribes, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians, and the Confederated Tribes of Warm Springs. Updates to the timeline of planning were identified every year at the annual meetings 2012 through 2015. On June 20, 2014, the Tribes listed above received a consultation package that included information about the proposed project location, proposed actions, and the purpose and need for the project.

1.6 Public Involvement Efforts

Public involvement efforts during the development of the DEIS included public meetings, open-houses, scoping letters, and publication of the project in the Willamette National Forest Schedule of Proposed Actions and Willamette National Forest website. Below is a timeline illustrating public involvement efforts for the Green Mountain project:

- January 1, 2013: Project published in the Willamette National Forest Schedule of Proposed Actions
- April 11, 2014: Notice of Intent (NOI) to prepare an EIS published in the Federal Register
- April 10, 2014: Scoping letter and background information mailed to members of the public, organizations, and state/federal agencies that have expressed interest in receiving information on District projects
- April 24, 2014; May 1, 2014: District open-house public meetings at McKenzie Bridge, Oregon
- May 2, 2014: Public meeting to discuss Green Mountain project held in McKenzie Bridge, Oregon
- May 9, 2014: Public meeting to discuss Green Mountain project held in Leaburg, Oregon

Members of the public, organizations, and state and federal agencies were invited to provide comments and concerns about the Green Mountain project during the public scoping comment period from April 10th through May 15th, 2014. Scoping comments received varied from those that wanted more clarification on proposed activities to specific suggestions for project implementation. Scoping comments were used to help develop planning issues, alternatives, and effects analysis for the DEIS.

All correspondence and comments are available in the Project Record at the McKenzie River Ranger District office.

1.7 Consultation with other Agencies

United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)

Upper Willamette River Chinook Salmon and Bull Trout

Endangered Species Act (ESA) informal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon and Columbia River bull trout is currently in progress. The Biological Evaluation prepared for the Green Mountain project found that the project “may affect, and is likely to adversely effect” Upper Willamette spring Chinook salmon and bull trout. This analysis also found that there would not be any adverse modification of designated critical habitat for either species. On October 14, 2014, the Green Mountain project was presented to the USFWS and NMFS and they concurred with the effects determination of “may affect, is likely to adversely effect.” A Biological Assessment is currently being prepared to enter into formal consultation with USFWS and NMFS. Consultation will be completed prior to publication of the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Green Mountain project. The Forest Service will be required to comply with the terms and conditions provided by the USFWS and NMFS in the Biological Opinion.

Northern Spotted Owl

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl was completed in 2012 and evaluated by the USFWS in the 2012 Biological Opinion (FWS reference 01EOFW00-2013-TA-0034) signed October 29, 2012.

U.S. Environmental Protection Agency (EPA)

During project scoping, the EPA submitted a list of recommendations for analysis and project design. This letter was reviewed and recommendations incorporated as appropriate. Per Forest Service regulations, this DEIS will be filed with the EPA’s Office of Federal Activities in Washington, DC, who will publish a notice of availability in the Federal Register.

Oregon State Historic Preservation Office

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project. In accordance with this PA, an appropriate inventory was conducted in 2011 and 2012. All known cultural sites in the Area of Potential Effect (project area) were protected by avoidance, resulting in a determination of “Historic Properties Avoided” on June 27, 2013. SHPO concurred with the Forest Service finding on January 27, 2015. Documentation has been retained in the Forest and District Heritage files.

1.8 Issues Derived from Public Comments

A standardized content analysis process was conducted to analyze the letters received during the public scoping comment period. Content analysis was designed to extract comments from each letter received, evaluate similar comments from different letters, and identify topics or issues of concern. During content analysis, the Interdisciplinary Team (IDT), with involvement and approval from the Responsible Official, identified issues and separated them into three categories: “key” issues, “other” issues, and “out of scope” issues.

Key Issues

Key issues represent an unresolved conflict associated with potential environmental effects of the proposed actions that cannot be resolved simply with mitigation or design features. Key issues are used to formulate alternatives and focus the analysis of environmental effects.

During the public scoping process, four key issues were identified from comments and questions:

Key Issue #1: Harvest treatments should not occur in stands over 80 years of age

Key Issue #2: No regeneration harvest should occur

Key Issue #3: Reduce miles of temporary road construction

Key Issue #4: Eliminate all new, permanent road construction

Alternative 3 was developed in response to Key Issues 1, 2, and 3. Alternative 3 eliminates harvest treatments in stands over 80 years of age, eliminates regeneration harvest, and reduces temporary road construction. In response to Key Issue 4, all new, permanent road construction was eliminated from Alternatives 2 and 3.

Other Issues and Out of Scope Issues

Other issues are minor issues that do not result in development of alternatives or focus the analysis of environmental effects. In most cases, the IDT is able to address these issues by refining the design of a project (i.e. dropping a unit from the project) or applying a design feature (i.e. requiring buffers around streams).

Out of Scope issues are those identified as being “out of scope” of this environmental analysis. These issues include those that are not or cannot be addressed or solved in this project-level analysis; issues already decided by law, regulation, or other higher level decisions; issues irrelevant to the decision being made; and/or issues that are conjectural or not supported by scientific evidence.

1.9 Decision Framework

The Responsible Official for this proposal is the Forest Supervisor of the Willamette National Forest. The Forest Supervisor will review the proposed actions, alternatives, and the environmental consequences in order to make the following decisions:

- Whether to implement the proposed actions and which alternative;

- What specific design features are needed;
- What specific project monitoring requirements are needed to ensure design features are implemented and effective; and
- What if any modifications would be made to the proposed actions and alternatives.

The decision will be based on:

- How well the selected alternative achieves the project purpose and need; and
- How well the selected alternative responds to analysis issues.

Chapter 2 - Alternatives

This chapter describes and compares the alternatives considered for the Green Mountain project. It includes a description and map of each alternative considered. This chapter also presents the alternatives in comparative form, defining the differences between each alternative in order to provide a clear basis for choice by the decision maker.

Three alternatives have been analyzed for this project: Alternative 1 - No-Action; Alternative 2 – Preferred Alternative; and Alternative 3 - No Regeneration Harvest and No Treatment in Stands Over 80 Years Old.

2.1 Alternative 1 – No Action

Alternative 1- No-Action assesses the current management situation of the affected environment as well as the future conditions should an action not be implemented. The No-Action alternative should not be confused with a baseline. Whereas a baseline is essentially a description of the affected environment at a fixed point in time, the No-Action alternative considers what effects would occur to forest ecosystems and resources in the project area if no action is taken.

The purpose and need of the proposed actions would not be met under Alternative 1, as no timber harvest would be implemented.

2.2 Alternative 2 – Preferred Alternative

Alternative 2 is the preferred alternative and was developed to fully meet the purpose and need for this project. Alternative 2 proposes to treat approximately 4,398 acres in the project area (Figure 8, 9, and 10). Harvest treatments proposed include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Harvest treatments would yield an estimated gross 89 million board feet of timber. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Approximately 10.3 miles of temporary road construction would occur and approximately 130 miles of existing road would be maintained under Alternative 2.

Alternative 2 would include treatments in Management Area 5a – Special Interest Areas (SIAs). The Green Mountain project proposes to treat approximately 206 acres in the South Fork McKenzie SIA and approximately 59 acres in the Hidden Lake-Lulu Lake SIA with thinning, gaps, and skips.

No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline MA-5a-05: "*No programmed harvest shall be scheduled.*" However, Implementation Guides for SIAs include objectives and enhancement recommendations for managing second growth plantations to accelerate growth and more quickly attain attributes of older stands; implementing silvicultural treatments in stands where densities are high or showing a reduction of growth to improve tree and stand vigor; maintaining health and aesthetics while maintaining decadence of the forest in and around Hidden Lake area through harvest of even-aged, previously managed stands; and accelerating late successional characteristics in young stands to enhance connectivity corridor between Late Successional Reserves.

Treatments proposed in the SIAs would move stands towards achieving the objectives and enhancement recommendations listed above and described in further detail in the Implementation Guides. Because no programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline 5a-05, a one-time exception approved with a non-significant Forest Plan amendment would be required. Please refer to Section 3.14 for additional information on the proposed Forest Plan amendment.

Table 4 includes a summary of treatments and connected actions proposed under Alternative 2. A detailed description of proposed treatments and project activities is included in Appendix A. A detailed list of treatments for individual units is listed in Appendix B.

Table 4. Summary of Proposed Treatments and Connected Actions – Alternative 2

Proposed Activity	Unit of Measure	Alternative 2	Purpose – Need Addressed[1]
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	1,454	1, 3
Thinning in Riparian Reserves	Acres	901	2
Regeneration Harvest	Acres	325	1, 3
Gaps	Acres	320	1, 2, 3
Dominant Tree Release	Acres	291	1, 3
Skips outside Riparian Reserves	Acres	346	3
Skips in Riparian Reserves	Acres	761	2, 3
Total	**Acres**	**4,398**	1, 2, 3
Estimated Gross Volume	**MMBF**	**~89**	**1**
Connected Actions			
Post-Harvest Fuels Treatments in Timber Harvest Units[2,3]			
Pile and Burn (mechanical and/or hand treatments)	Acres	2,496	3
Post-Harvest Underburn	Acres	795	3
Transportation			
New Road Construction	Miles	0	-
Temporary Road Construction	Miles	10.3	-
Roads Maintained	Miles	130	-
Road Decommissioning	Miles	2	-
Road Storage	Miles	21.1	-
Seasonal Road Closure Removed	Miles	6	-
Seasonal Road Closure Changed to Permanent Road Closure	Miles	3	-
Bridge Replacement (Hardy Creek)	-	Yes	-
Rock Obtained From Existing Quarries	Cubic Yards	15,000	-

Proposed Activity	Unit of Measure	Alternative 2	Purpose – Need Addressed[1]
Harvest System			
Helicopter	Acres	90	-
Skyline	Acres	2,436	-
Ground	Acres	765	-
Harvest Associated Planting, Snags, and Down Wood			
Planting in Regeneration Harvest	Acres	325	3
Planting in Gaps	Acres	130	3
Natural Regeneration in Gaps	Acres	190	3
Snags and Down Wood (occurs in regeneration units)	Snags per acre and liner feet of large down wood of decay classes I-II	Retain or create up to 5 snags per acre and at least 240 linear feet of down wood on approximately 43 acres.	3
Northern Spotted Owl (NSO) Habitat			
NSO Suitable Habitat in Critical Habitat Treated (including skips) [1]	Acres	57	3
NSO Dispersal Habitat in Critical Habitat Treated	Acres	1,187	3
NSO Non-Habitat Habitat in Critical Habitat Treated	Acres	76	3
NSO Suitable Habitat Treated (including skips) [1]	Acres	411	3
NSO Dispersal Habitat Treated (including skips) [1]	Acres	3,287	3
NSO Non-Habitat Treated (including skips) [1]	Acres	592	3
Gap and Fall and Leave Treatments in Riparian Reserves			
¼ Acre Non-commercial Gaps in Primary Shade Zone[1]	Acres	3.5	2, 3
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)[1]	Acres	4	2, 3
Fall and Leave to Add Wood to Stream Channels	Miles	2.7	2
Forest Plan Amendment (#58)			

Proposed Activity	Unit of Measure	Alternative 2	Purpose – Need Addressed[1]
South Fork McKenzie River Special Interest Area[2]	Acres	206	2, 3
Hidden Lake – Lulu Special Interest Area[2]	Acres	59	2, 3

1 - 1- Provide a sustainable supply of timber products; 2- Increase vegetative habitat complexity and hardwood composition along streams; and 3- Shift age class and structural diversity.

2 - These acres are already accounted for in the above table under "Timber Harvest Treatments" and therefore are not included in the total.

3 - Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device). Post-harvest fuels treatments methods may change depending on feasibility and funding.

Harvest treatments would occur in stands ranging from 26-144 years old. Approximately 320 acres proposed for harvest are in stands over 80 years old and 2,971 acres proposed for harvest are in stands under 80 years old. Table 5 provides a summary of forest age classes and treatment acres for Alternative 2.

Table 5. Summary of Forest Age Classes and Treatment Acres – Alternative 2

	<80 years old	80-120 years old	>120 years old
Acres of Harvest Units (including skips)	3,957	307	134
Acres Proposed for Harvest	2,971	207	113
Average Age	37	103	135

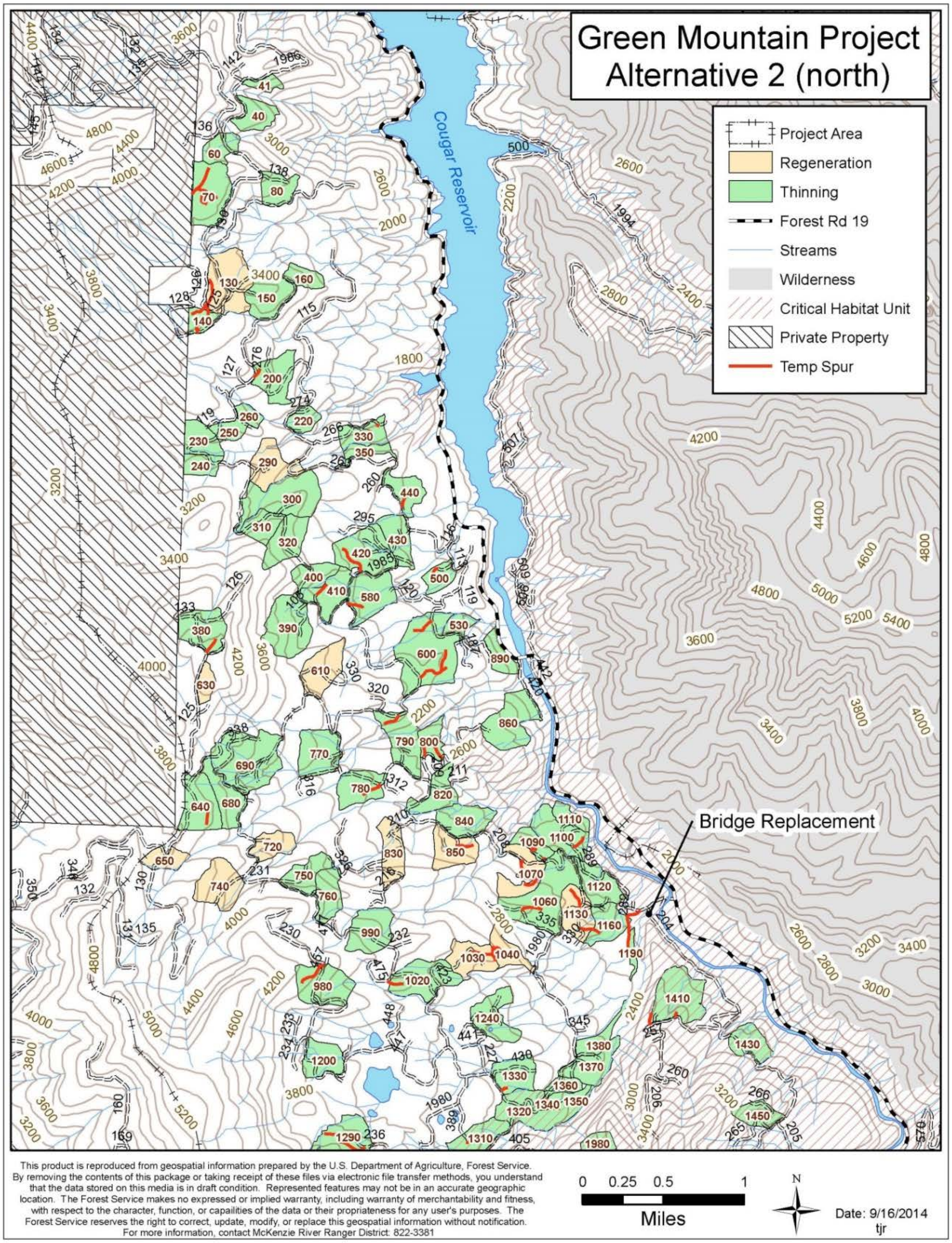


Figure 8. Map of Alternative 2 (North)

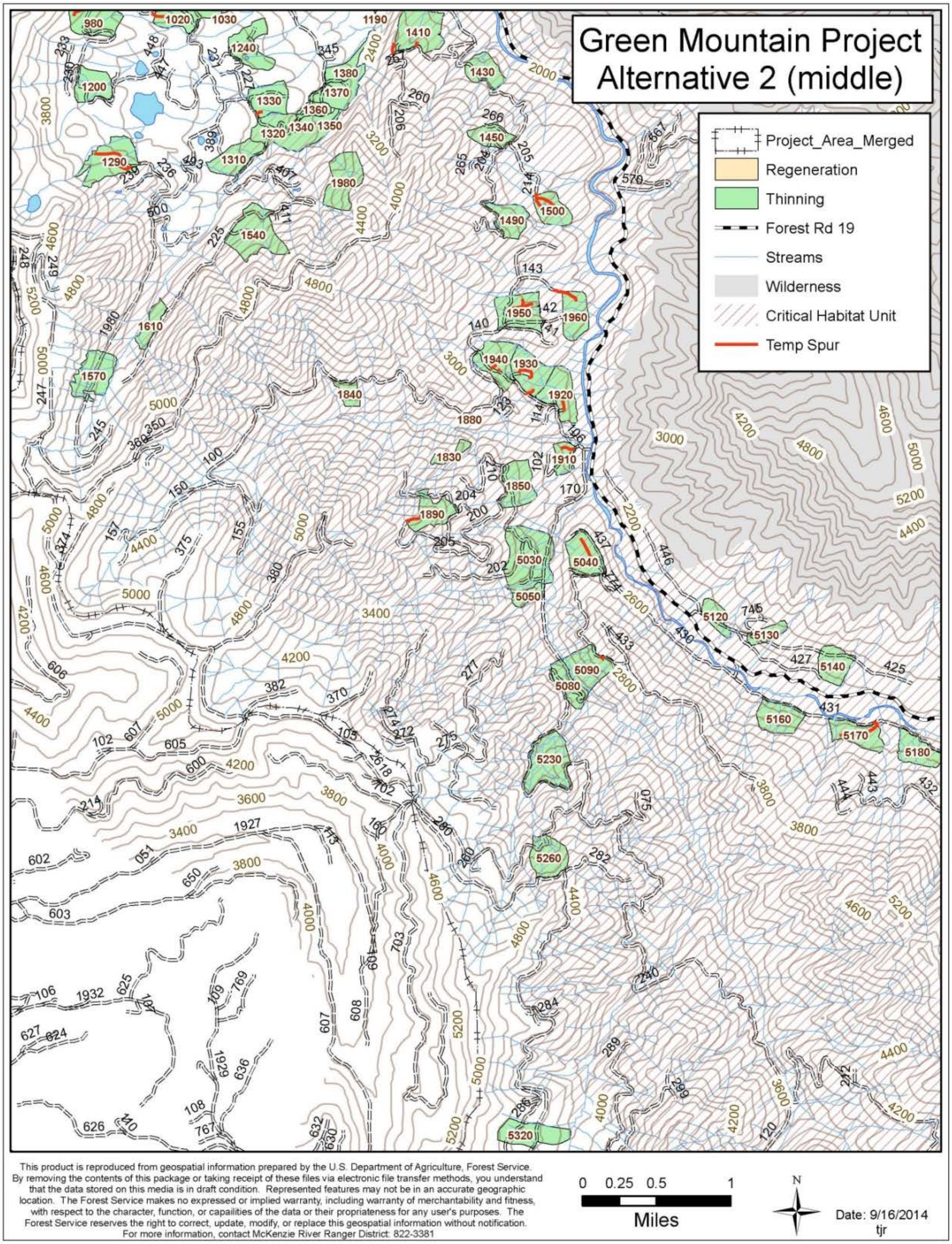


Figure 9. Map of Alternative 2 (Middle)

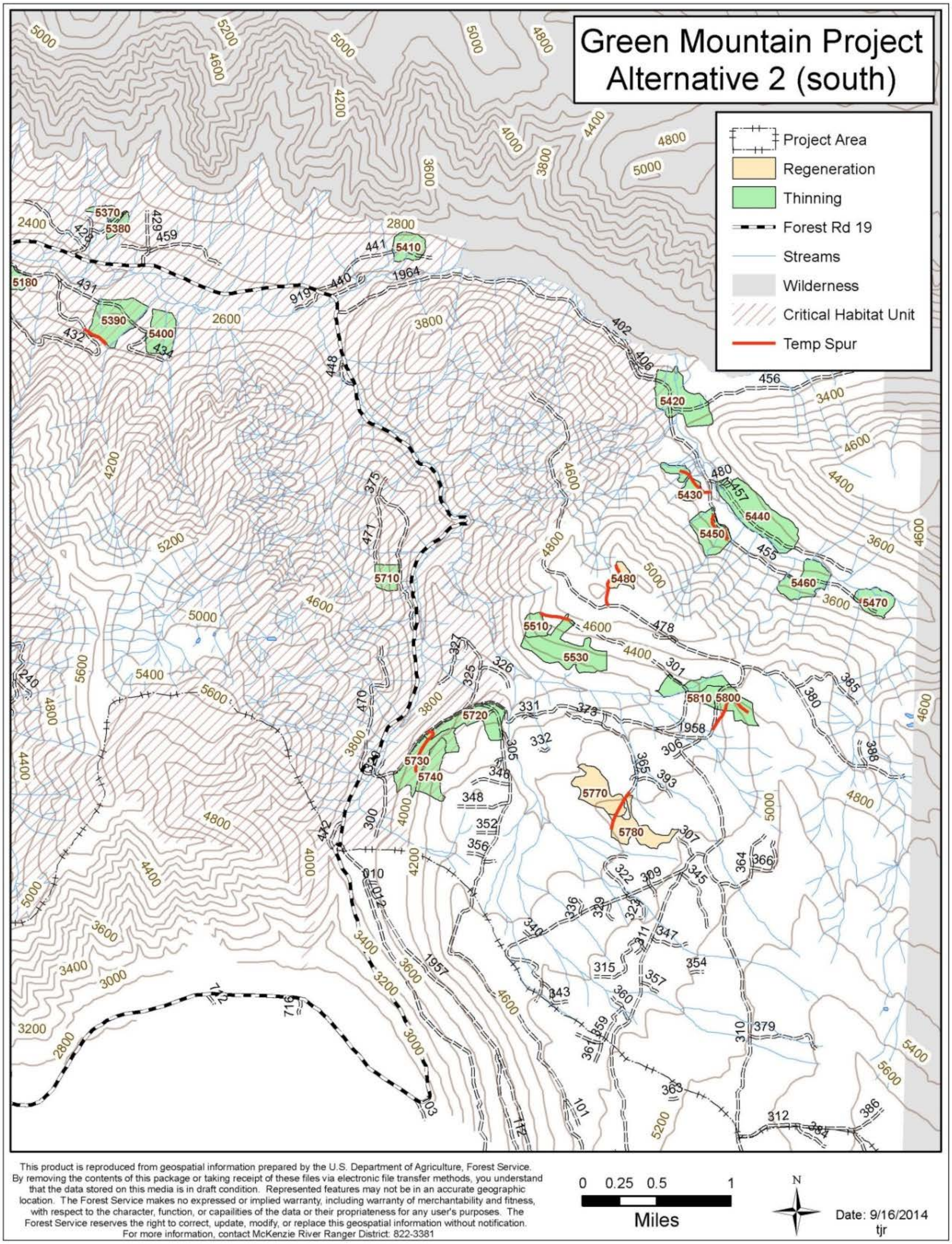


Figure 10. Map Alternative 2 (South)

2.3 Alternative 3 – No Regeneration Harvest and No Treatment in Stands Over 80 Years Old

During the EIS scoping process, four key issues were identified from comments and questions:

Key Issue #1: Harvest treatments should not occur in stands over 80 years of age

Key Issue #2: No regeneration harvest should occur

Key Issue #3: Reduce miles of temporary road construction

Key Issue #4: Eliminate all new, permanent road construction

Alternative 3 was developed in response to Key Issues 1, 2, and 3. Alternative 3 eliminates harvest treatments in stands over 80 years of age, eliminates regeneration harvest, and reduces temporary road construction. Additionally, Alternative 3 differs from Alternative 2 in that any regeneration harvest proposed in stands under 80 years of age were changed to thinning treatments; therefore, Alternative 3 has fewer acres of commercial harvest, but more acres of thinning, when compared to Alternative 2. In response to Key Issue 4, all new, permanent road construction was eliminated from Alternatives 2 and 3.

Alternative 3 proposes to treat approximately 3,957 acres in the project area (Figure 11, 12, and 13). Harvest treatments proposed include thinning, gap creation, dominant tree release, and skips. Harvest treatments would yield an estimated gross 68 million board feet of timber. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Approximately 8.6 miles of temporary road construction would occur and approximately 115 miles of existing road would be maintained under Alternative 3.

Alternative 3 would include treatments in Management Area 5a – Special Interest Areas (SIAs). The Green Mountain project proposes to treat approximately 206 acres in the South Fork McKenzie SIA and approximately 59 acres in the Hidden Lake-Lulu Lake SIA with thinning, gaps, and skips. No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline MA-5a-05: "*No programmed harvest shall be scheduled.*" However, Implementation Guides for SIAs include objectives and enhancement recommendations for managing second growth plantations to accelerate growth and more quickly attain attributes of older stands; implementing silvicultural treatments in stands where densities are high or showing a reduction of growth to improve tree and stand vigor; maintaining health and aesthetics while maintaining decadence of the forest in and around Hidden Lake area through harvest of even-aged, previously managed stands; and accelerating late successional characteristics in young stands to enhance connectivity corridor between Late Successional Reserves.

Treatments proposed in the SIAs would move stands towards achieving the objectives and enhancement recommendations listed above and described in further detail in the Implementation Guides. Because No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline 5a-05, a one-time exception approved with a non-significant Forest Plan amendment would be required. Please refer to Section 3.14 for additional information on the proposed Forest Plan amendment.

Table 6 includes a summary of treatments and connected actions proposed under Alternative 3. A detailed description of proposed treatments and project activities is included in Appendix A. A detailed list of treatments for individual units is listed in Appendix B.

Table 6. Summary of Proposed Treatments and Connected Actions – Alternative 3

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed[1]
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	1,597	1, 3
Thinning in Riparian Reserves	Acres	894	2
Regeneration Harvest	Acres	0	-
Gaps	Acres	261	1, 2, 3
Dominant Tree Release	Acres	206	1, 3
Skips outside Riparian Reserves	Acres	253	3
Skips in Riparian Reserves	Acres	747	2, 3
Total	**Acres**	**3,957**	1, 2, 3
Estimated Gross Volume	**MMBF**	**~68**	**1**
Connected Actions			
Post-Harvest Fuels Treatments in Timber Harvest Units[2,3]			
Pile and Burn (mechanical and/or hand treatments)	Acres	2,575	3
Post-Harvest Underburn	Acres	382	3
Transportation			
New Road Construction	Miles	0	-
Temporary Road Construction	Miles	8.6	-
Roads Maintained	Miles	115	-
Road Decommissioning	Miles	2	-
Road Storage	Miles	21.1	-
Seasonal Road Closure Removed	Miles	6	-
Seasonal Road Closure Changed to Permanent Road Closure	Miles	3	-
Bridge Replacement (Hardy Creek)	-	Yes	-
Rock Obtained From Existing Quarries	Cubic Yards	15,000	-
Harvest System			
Helicopter	Acres	90	-

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed[1]
Skyline	Acres	2,265	-
Ground	Acres	602	-
Harvest Associated Planting, Snags, and Down Wood			
Planting in Regeneration Harvest	Acres	0	-
Planting in Gaps	Acres	53	3
Natural Regeneration in Gaps	Acres	208	3
Snags and Down Wood (occurs in regeneration units)	Snags per acre and liner feet of large down wood of decay classes I-II	0	-
Northern Spotted Owl (NSO) Habitat			
NSO Suitable Habitat in Critical Habitat Treated (including skips) [1]	Acres	0	3
NSO Dispersal Habitat in Critical Habitat Treated	Acres	1,187	3
NSO Non-Habitat Habitat in Critical Habitat Treated	Acres	76	3
NSO Suitable Habitat Treated (including skips) [1]	Acres	0	3
NSO Dispersal Habitat Treated (including skips) [1]	Acres	3,287	3
NSO Non-Habitat Treated (including skips) [1]	Acres	592	3
Gap and Fall and Leave Treatments in Riparian Reserves			
¼ Acre Non-commercial Gaps in Primary Shade Zone[1]	Acres	3.5	2, 3
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)[1]	Acres	4	2, 3
Fall and Leave to Add Wood to Stream Channels	Miles	2.7	2
Forest Plan Amendment (#58)			
South Fork McKenzie River Special Interest Area[2]	Acres	206	2, 3
Hidden Lake – Lulu Special Interest Area[2]	Acres	59	2, 3

1 - 1- Provide a sustainable supply of timber products; 2- Increase vegetative habitat complexity and hardwood composition along streams; and 3- Shift age class and structural diversity.
2 - These acres are already accounted for in the above table under “Timber Harvest Treatments” and therefore are not included in the total.

3 - Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device). Post-harvest fuels treatments methods may change depending on feasibility and funding.

Harvest treatments would occur in stands ranging from 26-76 years old. No harvest would occur in stands over 80 years old. Table 8 provides a summary of forest age classes and treatment acres for Alternative 3.

Table 7. Summary of Forest Age Classes and Treatment Acres – Alternative 3

	<80 years old	80-120 years old	>120 years old
Acres of Harvest Units (including skips)	3,957	0	0
Acres Proposed for Harvest	2,957	0	0
Average Age	37	-	-

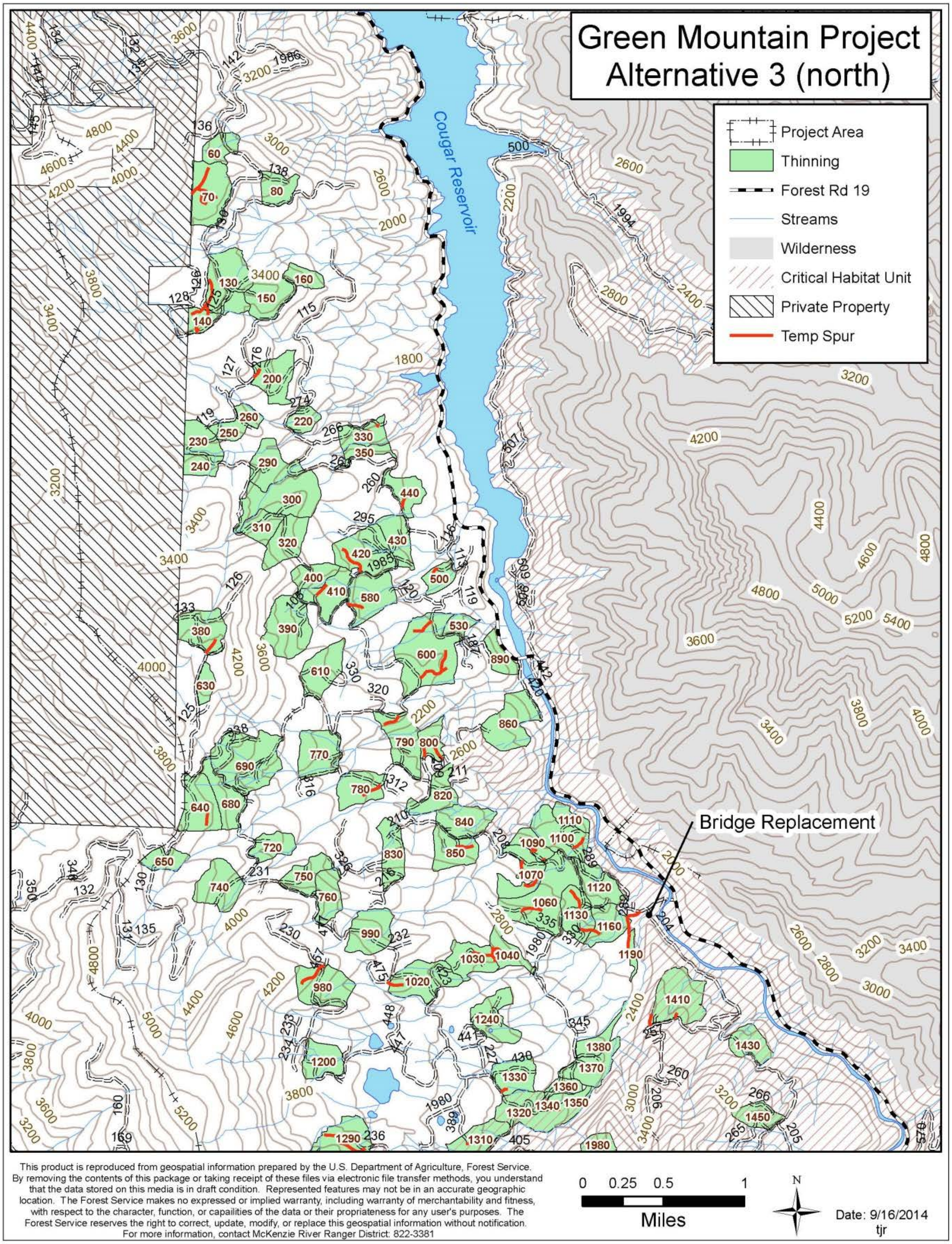


Figure 11. Map of Alternative 3 (North)

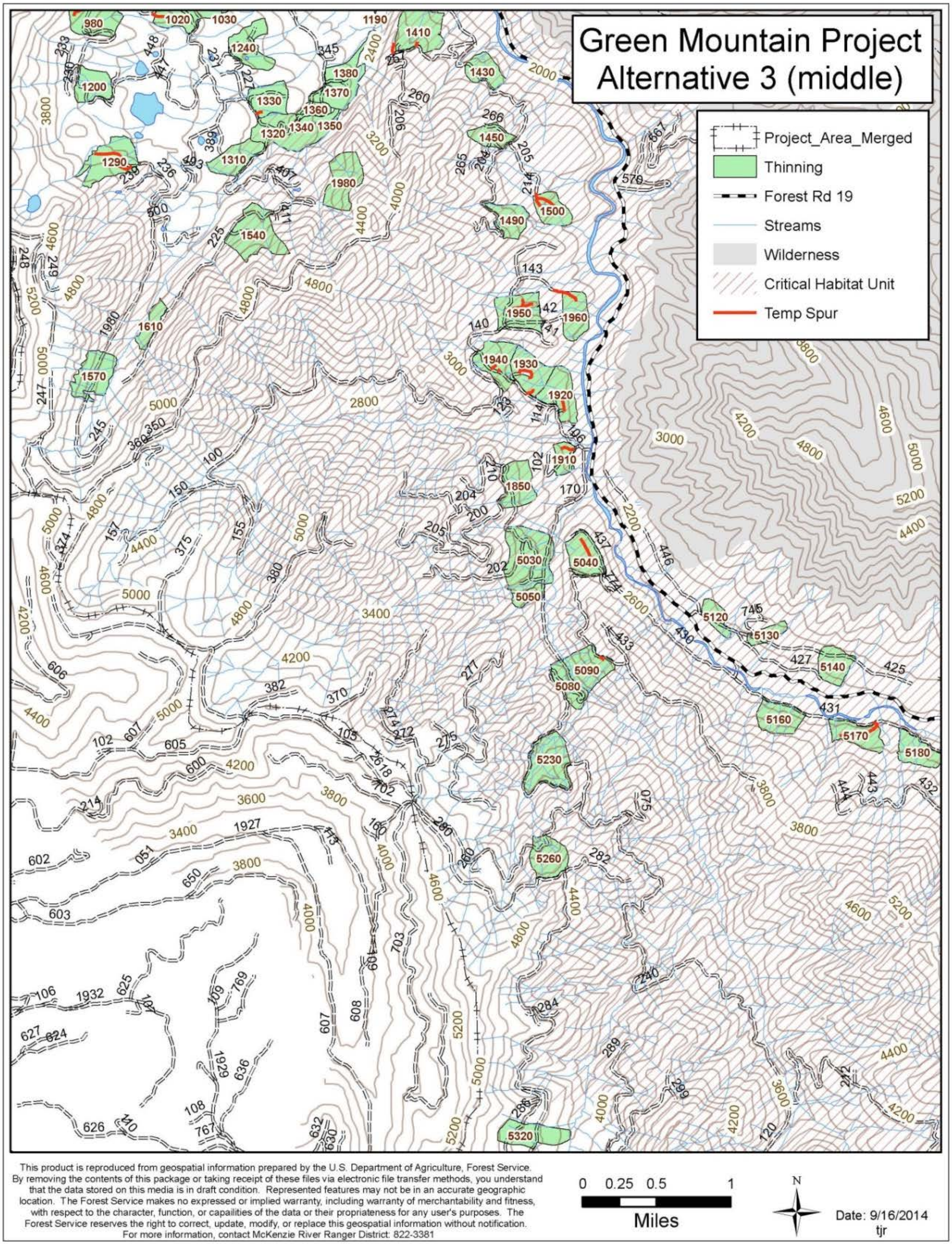


Figure 12. Map of Alternative 3 (Middle)

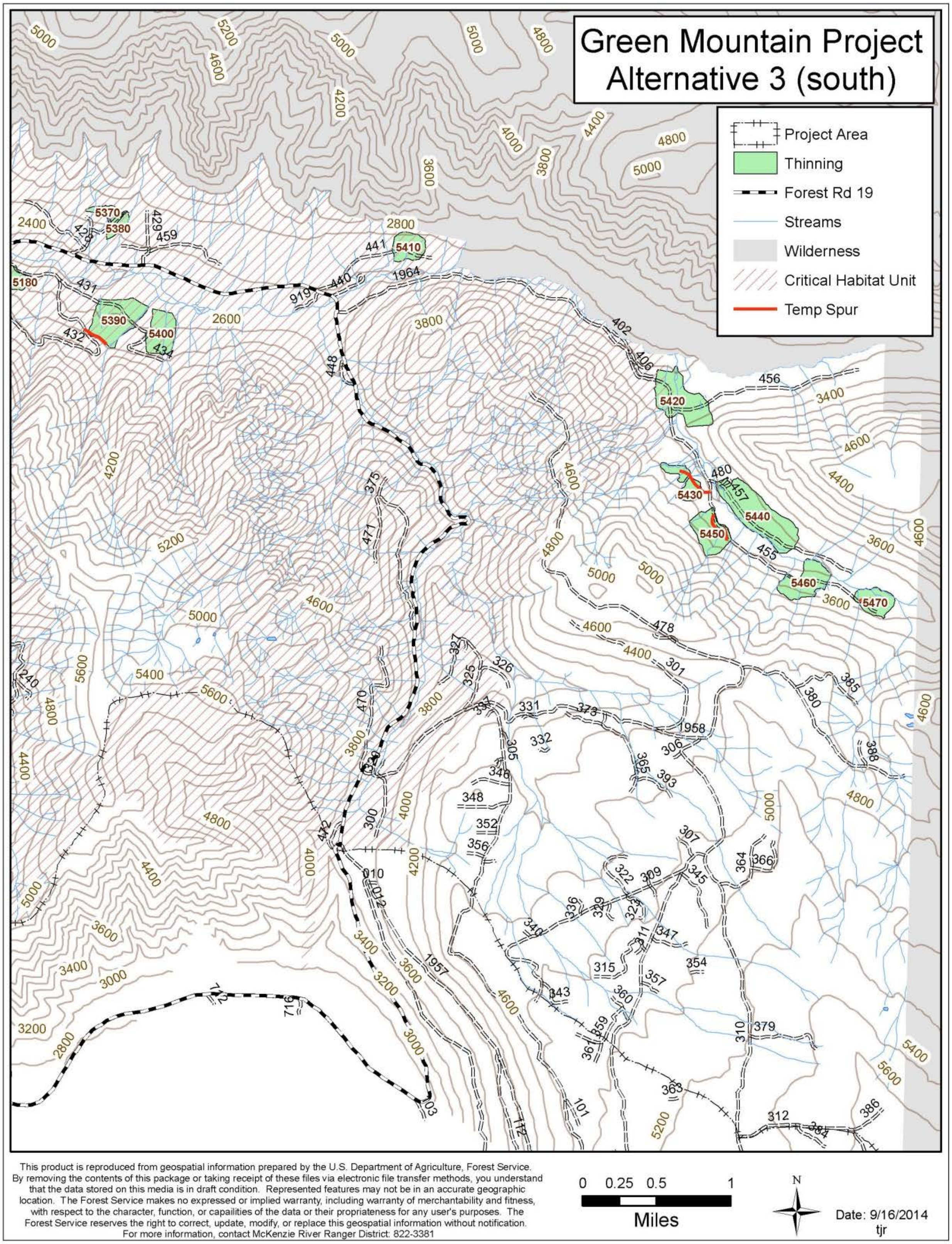


Figure 13. Map of Alternative 3 (South)

2.4 Alternatives Considered But Eliminated

Alternative that Includes Increased Acreage of Regeneration Harvest to More Quickly Achieve the Desired Age Distribution in the Landscape and to Regenerate within Northern Spotted Owl Critical Habitat (CHU)

The original proposed action included 1,250 acres of regeneration harvest to more quickly achieve the desired age distribution in the landscape. In 2012, the US Fish and Wildlife Service released the final Critical Habitat designation for the Northern Spotted Owl, which included Critical Habitat Units (CHU) in numerous stands in the project area proposed for regeneration harvest. While the final CHU designation does give flexibility to achieve the project's purpose and need within CHUs, its primary purpose is to protect and improve existing habitat within the CHU. The Willamette National Forest determined that the purpose and need of the proposed project could be achieved while not regenerating within the CHUs. As such, the original proposed action was modified (see Alternative 2) to include only 324 acres of regeneration harvest rather than analyzing it as a separate alternative.

Alternative that Limits Proposed Harvest in Contiguous Blocks 1000 Acres or Greater that Do Not Have Roads

There was a request to not harvest in blocks that are at least 1000 acres in size and that do not currently have roads. Within the project area, there are seven polygons meeting this contiguous block criteria that range in size from 1,122 to 9,798 acres and total 17,966 acres. Alternative 3 is nearly identical to this request with the exception of one managed stand, unit 1290, which is 51 acres in size. This stand is approximately 44 year old, and is overly dense with about 290 trees per acre larger than seven inch diameter at breast height and a canopy cover exceeding 80 percent. Additionally, this 1000 plus acre polygon surrounds an existing road into the unit which is near a ridge top that has remnant skid trails from the previous ground based logging. Because Alternative 3 is nearly identical to this requested alternative, with the exception of one unit, it was eliminated from detailed study to avoid duplication among alternatives.

2.5 Comparison of Alternatives

Table 8 summarizes and compares treatments and connected actions that would occur under each alternative.

Table 8. Comparison of Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Treatments				
Thinning outside Riparian Reserves	Acres	0	1,454	1,596
Thinning in Riparian Reserves	Acres	0	901	894
Regeneration Harvest	Acres	0	325	0
Gaps	Acres	0	320	261
Dominant Tree Release	Acres	0	291	206

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Skips outside Riparian Reserves	Acres	0	346	253
Skips In Riparian Reserves	Acres	0	761	747
Total	**Acres**	**0**	**4,398**	**3,957**
Estimated Gross Volume	**MMBF**	**0**	**~89**	**~68**
Post-Harvest Fuels Treatments in Timber Harvest Units				
Pile and Burn (mechanical and/ or hand treatments)[1]	Acres	0	2,496	2,575
Post-Harvest Underburn[1]	Acres	0	795	382
Road Activities Associated with Harvest				
New Road Construction	Miles	0	0	0
Temporary Road Construction	Miles	0	10.3	8.6
Roads Maintained	Miles	0	130	115
Road Decommissioning	Miles	0	2	2
Road Storage	Miles	0	21.1	21.1
Seasonal Road Closure Removed	Miles	0	6	6
Seasonal Road Closure Changed to Permanent Road Closure	Miles	0	3	3
Bridge Replacement (Hardy Creek)	-	No	Yes	Yes
Rock obtained from expanding existing quarries	Cubic Yards	0	15,000	15,000
Acres by Harvest System				
Helicopter Harvest	Acres	0	90	90
Skyline Harvest	Acres	0	2,436	2,265
Ground-based Harvest	Acres	0	765	602
Harvest Associated Planting, Snags, and Down Wood				
Planting in Regeneration Harvest	Acres	0	325	0
Planting in Gaps	Acres	0	130	53
Natural Regeneration in Gaps	Acres	0	190	208

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Snags and Down Wood (occurs in regeneration units)		0	Retain or create up to 5 snags per acre and at least 240 linear feet of down wood on approximately 43 acres.	0
Northern Spotted Owl (NSO) Habitat				
NSO Suitable Habitat in Critical Habitat Treated	Acres	0	57	0
NSO Dispersal Habitat in Critical Habitat Treated	Acres	0	1,187	1,187
NSO Non-Habitat Habitat in Critical Habitat Treated	Acres	0	76	76
NSO Suitable Habitat Treated (including skips) [1]	Acres	0	411	0
NSO Dispersal Habitat Treated (including skips) [1]	Acres	0	3,287	3,287
NSO Non-Habitat Treated (including skips) [1]	Acres	0	592	592
Gap and Fall and Leave Treatments in Riparian Reserves				
¼ Acre Non-commercial Gaps in Primary Shade Zone[1]	Acres	0	3.5	3.5
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)[1]	Acres	0	4	4
Fall and Leave to Add Wood to Stream Channels	Miles	0	2.7	2.7
Forest Plan Amendment (#58)				
South Fork McKenzie River Special Interest Area[1]	-	No	Yes	Yes
Hidden Lake – Lulu Special Interest Area[1]	-	No	Yes	Yes
Key Issues 1, 2, 3, and 4				
Harvest treatments in stands over 80 years of age[1]	Acres	0	441	0
Regeneration Harvest[1]	Acres	0	325	0
Temporary Road Construction	Miles	0	10.3	8.6
New, Permanent Road Construction	Miles	0	0	0

1 These acres are already accounted for in the above table under "Timber Harvest Treatments" and are not additional to the number above. Non-commercial gaps are enhancements which would occur after harvest.

2.6 Design Features

The design features in Table 9 were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices.

Table 9. Design Features Common to Alternative 2 and Alternative 3

	Objective	Design Feature	Location
	Forest and Stand Structure		
1	Meet stocking requirements as identified in the National Forest Management Act (NFMA) planting would be used in addition to natural regeneration to ensure full stocking	Plant at 15' x 15' spacing, or about 194 trees per acre. The species mix should contain Douglas-fir, western white pine, sugar pine, and western red cedar. Stratify the mix with Douglas-fir quantities higher in the lower elevations and western red cedar higher in the moister sites. Sugar pine and western red cedar will vary with sugar pine more prominent in warmer drier sites.	All harvest units where planting is to occur
2	Protect integrity of IRA	During presale, verify that no encroachment on the IRA exists.	Units: 5320,5420,5800
3	Maintain structural diversity	During presale, protect identified trees with raptor nests and those with unusual structure such as broken tops.	All harvest units
4	Minimize damage during harvest	Protect residual stand and reserve trees to the best extent possible from treatment damage.	All harvest units
	Soils, Hydrology, and Aquatic Resources		
5	To reduce compaction and undesirable soil damage	Primary landings, temporary haul or principal skid roads utilized by the purchaser / logger should be subsoiled (to a depth of 18 to 24 inches) at the completion of logging activities.	Units 70, 610, 1030, 1500, 1930, 5120, 5130, 5140
6	To reduce compaction and undesirable soil damage	No ground based operations permitted below the 1900425 road.	Units 5120, 5130, 5140
7	To reduce compaction and undesirable soil damage	Existing landings, temporary haul roads, old primary skid roads, and/or tractor fire lines would be utilized as much as possible prior to disturbing new areas.	All harvest units
8	To minimize erosion and sedimentation	Construction or maintenance of roads would not be done when soils are saturated or run-off occurs. A stable fill would be constructed across all streams when crossed by new temporary roads.	All harvest units and associated access.

	Objective	Design Feature	Location
9	To minimize erosion and sedimentation	Native surfaced roads would be restricted from hauling when soils are saturated or run-off occurs.	All harvest units and associated access.
10	To minimize potential impacts to fish.	Any project activity such as culvert replacement that must occur within fish-bearing streams would comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions on in-stream work activities (July 1st – August 15th). If a waiver to these dates is required the district fisheries biologist will need to review the proposal and seek a waiver from ODFW, NMFS, and the USFWS if it is warranted. Best Management Practices (BMP's), including placement of sediment barriers, provision of flow bypass, and other applicable measures, would be included in project design as necessary to control off-site movement of sediment.	Entire project area
11	To prevent sedimentation	All haul roads would be maintained in stable condition. Wet weather haul would be monitored by the Timber Sale Administrator, the District Road Manager, Fisheries Biologist, and/or Hydrologist. When necessary, haul may be suspended during rainfall to prevent off-site movement of sediment into drainage courses. Haul may also occur when the road surface is either covered with a relatively continuous snow pack or is frozen. Dust abatement of road surfaces would be used if roads become excessively dusty during the summer.	All harvest units
12	To reduce contamination to aquatic areas	If lignin sulfate is used for dust abatement, one application would occur during the dry season (July/August/September) at a dilution rate of 50% lignin sulfate and 50% water. Lignosulfonate would remain on the road surface and not go over road edge. During blading, small berms could be created or wattles used at stream crossings to assist with keeping palliatives on the road surface. A 1 foot no-application buffer on the edge of gravel would be used if road width allows. Lignosulfonate would not be applied when raining and when possible, a 3 day forecast of clear weather would follow application.	All harvest units

	Objective	Design Feature	Location
13	To reduce off-site movement of sediment into drainage courses	Ground-based equipment used for yarding, processing, fuel treatment, or other project activities would operate only when soils are relatively dry where water is not pooling. Stop work if trenching, or rutting detected. Operations would be suspended before rainfall or precipitation results in off-site movement of sediment into drainage courses. Snow/frozen soil may be operated on in the following conditions: • 0 inches of frozen soil−Need at least 18 inches of settled snow • 4 inches of frozen soil−Need at least 9 inches of settled snow • 6 inches of frozen soil−No snow cover necessary If necessary, pre-pack snow on designated routes before work commences. This allows soil to freeze and the snow road to solidify.	All harvest units
14	Undesirable soil damage from skidding would be avoided through skid trail layout and use of alternative yarding systems	Ground-based equipment should be limited to slopes less than 30 percent. Timber sale administrators may approve equipment use on slopes from 30-40% for short pitches based on site specific conditions. The upper limit for prebunching is on 45% slope. All equipment trails need to be prelocated and preapproved. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment.	All harvest units
15	To reduce compaction directly adjacent to stream channels.	Ground based equipment and skid roads should be at least 50 feet from the no-cut buffer for all streams (fish-bearing to intermittent). These widths are required unless a change is approved by the district hydrologist or district fish biologist.	All harvest units
16	Minimize impacts to stream channels.	Full suspension over the high water mark would be required when yarding over perennial stream channels. Full suspension is preferred over intermittent streams, however where full suspension is not obtainable partial suspension would be required and yarding would be limited to when the stream is dry. Bump logs to protect the stream channel would be utilized as appropriate.	All harvest units
17	Minimize impacts to stream channels.	Where cable yarding requires corridors through a riparian area, corridors would be laid out to minimize the number of trees cut. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors would be felled towards the channel (if feasible) and left on site.	All harvest units

	Objective	Design Feature	Location
18	To provide adequate drainage and avoid unnecessary soil disturbance	All skid trails and landings should be water-barred to provide adequate drainage. Water bar location should occur where local terrain facilitates effective drainage of the skid trail or landing while avoiding unnecessary soil disturbance. An example would be to construct water bars every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be keyed-in to the cut bank and have a clear outlet on the downhill side. In lieu of waterbars, where available in concentrations, slash can be scattered on corridors, skid trails and landings.	All harvest units
19	Reduce compaction	Primary skid trails and landings in harvest units with ground-based yarding should be sub soiled to a depth of 18-24 inches at the completion of project activities. Primary skid trails in gaps as well as all temporary landings should be sub-soiled to a depth of 18-24 inches or to bedrock.	All harvest units
20	To prevent sedimentation	All areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance would be seeded with sterile seed, native grasses, or weed free mulch unless agreed to otherwise.	All harvest units
21	To prevent sedimentation	Scarification and waterbars may be limited or suspended on feller buncher/ processor/ forwarder roads when the skid road is sufficiently covered with slash to form an effective mat to minimize soil compaction and erosion.	All harvest units
22	To reduce soil disturbance and the risk of erosion in Riparian Reserves	Fire line for underburning would not be constructed along no-cut riparian buffer areas. Fire would only be allowed to back into riparian areas.	All harvest units
23	To reduce soil disturbance.	The west boundary of Unit 160 has an existing debris chute type failures as well as additional potentially unstable and unsuited rocky ground. This area would be deleted from the unit at layout and not affected by timber management. Soils/Geology personnel may assist in the layout of this unit.	Unit 160
24	To reestablish hydrologic and geologic processes	Temporary roads would be made hydrologically stable and removed after completion of project activities. Removal of temporary roads may include: blocking the entrance, removal of culverts, out-sloping the road surface, pulling back displaced material onto the road way, installation of water bars, re-vegetation of the road prism, and/or the sub soiling of compacted surfaces when necessary.	All harvest units

	Objective	Design Feature	Location
25	To protect key riparian features and integrity	All existing down wood would be retained within Riparian Reserves to maintain aquatic objectives.	All harvest units
26	To ensure sufficient water flow in streams	Water sources used by project operations would be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality. Water used for fire treatments and dust abatement will be drafted from various water sources outside of Listed Fish Habitat. At all drafting locations, 90% of stream flow would be maintained to reduce risk to aquatic species and water quality.	Entire project area
27	To protect and enhance riparian features	Riparian buffer see Appendix G.	All harvest units
	Wildlife		
28	To protect existing downed wood within the landscape	Existing large down woody material should be retained within harvest units.	All Harvest Units
29	To provide downed wood and emulate material seen following a natural disturbance	Up to 5 trees per acre may be fallen after harvest to ensure a minimum of 240 linear feet of downed wood in decay classes 1 and 2.	Regeneration Units
30	To enhance downed wood within the landscape	Up to 4 trees per acre, of the average size within the unit, may be fallen after harvest with site specific recommendation by the district wildlife biologist.	All Thinning Units
31	To provide snags and emulate effects of mortality following a natural disturbance	Retain or create up to 5 large snags per acre after logging. Residual trees with diseases may substitute for snag creation. One snag/acre will have “kerf cuts” in the trunk to provide habitat for roosting bats.	Regeneration Units
32	To enhance snag levels within the landscape	Up to 4 trees per acre, of the average size within the unit, may be used for snag creation after harvest with site specific recommendation by the district wildlife biologist.	All Thinning Units
33	To provide snags and emulate effects of mortality following fire	Retain existing snags where possible, except those needed to be fallen for safety or operational purposes. Those cut during operations should remain as down wood.	All Harvest Units
34	To reduce impacts to bats	During layout, look for snags and trees that have cavities or sloughing bark that could be used as natal or roost sites by bats. If these are found, retain them, where possible, by incorporating them into skips or leave trees.	All Harvest Units
35	To reduce disturbance to nesting birds and during popular hunting periods	Snag creation and large down wood placement activities will have seasonal restrictions applied and will not occur during general elk rifle season.	Snag and large down wood placement units.

	Objective	Design Feature	Location
36	To reduce disturbance to nesting birds	When possible, conduct prescribed burning during the fall when conditions allow.	Units with underburn.
37	To reduce disturbance during nesting season of peregrine falcons	Restriction on falling trees, ground-based yarding, and helicopter yarding between January15-July 31.	Units 40, 41, 1290, 1320, 1350, 1360, 1370, 1380, 1430, 1450, 1540, 1980, 5370, 5380, 5390, 5410, 5420, 5440 and 5450.
38	To reduce disturbance during nesting season of northern spotted owls	Restriction on falling trees and ground-based yarding between March 1-July 15.	Units 200 (east half only), 310, 320, 1940, 5510, 5530, 5800, and 5810.
39	To reduce disturbance during the critical nesting of Great Gray Owls	Restriction on falling trees and all yarding activities between March 15-May 15.	Units 5510, 5530, and the area below road 1958 on units 5800 and 5810
40	To reduce disturbance during nesting season of cavity nesters	Conduct roadside hazard felling outside the critical seasonal restriction period for cavity nesters which is from April 1-June 30. This may be waived on a case-by-case basis by the wildlife biologist.	All roadside hazard tree maintenance
41	To reduce disturbance during the nesting season of northern spotted owls	Restriction on prescribed unit underburning between March 1-July 15, without clearance by district wildlife biologist.	Units 150, 160, 200, 220, 300, 310, 320, 380, 390, 400, 410 (west half only), 820, 840, 860, 1070 (north half only), 1090, 1100, 1110, 1430, 1450, 1540 (western 1/3 only), 1610, 1880, 1940, 5030, 5300, 5410, 5420, 5440, 5470, 5510, 5530, 5720, 5800, and 5810.
42	To minimize effects to species of concern	If previously undocumented goshawk or other raptor nests are found during layout or sale administration, project modifications including contract modifications to remove acreage would be made as needed to protect the nest site and reduce harm to birds.	All harvest units
43	To protect and maintain Johnson’s Hairstreak (butterfly) habitat	Mark for retention any identified western hemlock trees which contain dwarf mistletoe	All harvest units.
44	To protect habitat for the Crater Lake Tightcoil.	Prevent ground/habitat disturbance within 10 meters (approximately 30 feet) of perennially wet areas during project activities.	All harvest units
45	To protect locations of the sensitive Cascades Axetail Slug and the Survey and Manage Oregon Megomphix	180-foot no-harvest and no-burn buffers. Because the location in Unit 690 is about 100 feet from Road 1985, the protection buffer will only apply south of the road. Presale to get GPS location from the district wildlife biologist.	Units 390 (3 locations) and 690 (1 location).

	Objective	Design Feature	Location
46	To minimize potential conflict between hunters and contractors.	A seasonal operating restriction would restrict all operations behind closed gates during the Cascade Elk Rifle season, which is typically the third week of October. All non-emergency vehicle traffic would be restricted on closed roads beginning the Friday before that week through the end of the following Friday.	All harvest units
47	To protect any discovered Threatened, Endangered, or Sensitive (TES)	If TES wildlife species are found in future field work or during activities associated with this project, and potential for adverse effects exists, project modifications would be pursued. All contracts would include provisions to provide required protection measures in the event of TES species discovery.	All harvest units
	Botany		
48	To reduce the introduction/spread of weeds	All road construction and logging equipment shall be cleaned prior to entering working in the area.	Entire project area
49	To reduce the introduction/spread of weeds	Equipment should work in non-infested areas and then move to infested areas (USFS would provide map). If the purchaser elects to move from an infested area to a non-infested area, equipment shall be washed prior to leaving the infested area.	All harvest units
50	Reduce the introduction/spread of weeds	Clean fill (soil or rock free of slash and debris) would be used for construction of temporary roads. Sources of rock and fill material needs to be free of invasive plants. Rock quarries that may be used would be surveyed for invasive plants prior to use. If invasive plants are found, they would be treated as necessary prior to use.	All harvest units
51	To reduce the introduction of weeds	Use weed-free rock for all road construction and maintenance.	Entire project area
52	To reduce area for weeds to germinate	Minimize soil disturbance (minimize fireline construction, reuse old skid roads) to meet project objectives.	All harvest units
53	To reduce the introduction of weeds and prevent sedimentation.	Disturbed areas (culverts, road shoulders, closed/obliterated roads, landings, skid trails) should be re-vegetated with weed free native seed to compete with invasive plants as soon as possible. Weed free mulch would be used if necessary. Monitor sites and reseed or replant as necessary.	Entire project area
54	To reduce the introduction of weeds	Roads to be closed or decommissioned would be treated for invasive plants prior to closing.	Entire project area
55	To protect known occurrences of sensitive plant species.	180 foot buffers around known sensitive plants species.	260, 580, 990, and 1680

	Objective	Design Feature	Location
56	To protect known special habitats.	Buffers identified in Table 54 would be implemented to protect special habitats.	Units identified in Table 54
57	Reduce the potential for spread of invasive plants.	One or a combination of Integrated Pest Management practices (i.e. manual, mechanical, chemical, mulch) would be used to treat invasive plant species found in the project area. Existing infestations should be treated prior to project implementation to minimize seed spread.	All harvest units
	Heritage Resources		
58	Protect previously unidentified heritage resources	Project activities planned outside of the area defined in the heritage resource inventory schema must be coordinated with the Zone Archaeologist prior to initiation.	All harvest units
59	Protect previously unidentified heritage resources	If cultural resources are encountered during the course of this project, earth-disturbing activities in the vicinity of the find must be suspended, in accordance with federal regulations, and the Zone Archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract provision B(T)6.24 must be included in all project contracts.	Entire project area
60	Protect previously unidentified heritage resources	All units proposed for subsoiling must contact the Zone Archaeologist prior to activities for post-harvest surveys.	Entire project area
61	Protect previously unidentified heritage resources	Changes to current unit configuration would require coordination with the Zone Archeologist to protect know or unknown heritage resources.	All harvest units
62	Protect previously identified heritage resources	Activities associated with the following nine sites: 06180100156, -177, -185, -240, -251, -265, -292, -692, -699, -714 shall be coordinated with the Zone Archaeologist, to make sure the areas are excluded from the units.	See: Zone Archaeologist
	Roads		
63	Protect against sediment	Best Management Practices (BMPs), including placement of sediment barriers, provision of flow bypass, and other applicable measures, would be included as necessary to control off-site movement of sediment.	Entire project area
64	Protect against sediment	For any perennial stream crossing culvert replacement, a specific dewatering plan shall be included with the contract design provisions.	Entire project area

	Objective	Design Feature	Location
65	Protect against sediment	All road reopening, reconstruction and temporary road building would occur when soils are relatively dry to avoid potential surface erosion of exposed soil.	Entire project area
66	Protect against sediment	All temporary roads shall be made hydrologically stable if not being used during extended periods of wet weather.	Entire project area
67	Protect road infrastructure	Road maintenance along haul routes, including placement of additional surface rock, blading, brushing, ditch relief culvert cleaning or addition of ditch relief culverts should occur prior to project implementation.	Entire project area
68	Protect road infrastructure	At the completion of harvest and associated activities, reopened roads shall be closed (stored) and new temporary roads shall be decommissioned. Closed roads and decommissioned roads shall be placed in a hydrologically stable condition	Entire project area
69	Minimize impacts to recreating public.	No haul on weekends April 15 through Sept 30. S&G MA-6B-30.	Entire project area
70	To reduce impacts to recreating public	Post advance notice when disruption, such as harvest, may impact recreational opportunities at the following locations: Bruckart boat launch, Cougar Crossing, Slide Creek, Sunnyside, Red Diamond, Hard Rock, French Pete, Frissell Crossing, Roaring River, Box Canyon Horse Camp, Box Canyon Guard Station, Terwilliger Hot Springs, Indian Ridge Lookout and Hidden Lake. Post notice at the impacted site, and the Rd. 19 entrance bulletin board. Work with recreation specialist prior to project activities to ensure appropriate sites are posted.	Entire project area
71	To protect trails and recreating public experience using trails	Post advance notice of potentially disruptive activities, such as harvest, at primary trailheads for the following trails: 3510 (Elk Creek Trail), 3320 (Frissell Crossing), 3327 (South Fork Trail), and 3523 (McBea Trail). Recreation specialist will work with presale for design and layout of the units, and to determine locations where trail postings are needed.	Units 5780, 5420, 5410
	Scenic Quality		
72	To minimize visual impacts	Gaps should appear natural and subordinate to the natural landscape	All harvest units
73	To minimize visual impacts	Avoid temporary road layout perpendicular to the slope.	Units 1200 and 1290
74	To minimizie visual impacts	Uneven variable spacing, feather upper edge and side edges.	Unit 1290

	Objective	Design Feature	Location
75	To minimize visual impacts	Uneven varial space, feather north and south.	Unit 1200
76	To minimize visual impacts	Include a 75ft. harvest buffer between FS RD19 and harvest activity in the unit. Post advance notice of harvest activities at Cougar Crossing Day Use area and campground.	Unit 890
77	To minimize visual impacts	Uneven variable spacing, feather upper edge and portions of side.	Unit 890
78	To minimize visual impacts	Uneven variable spacing, feather north side, upper half, and upper part of sides.	Unit 860
79	To minimize visual impacts	As much as possible, while staying within the Region 6 Theft Prevention plan, orient leave tree and other pre-sale boundary markers away from trails in those areas where units are adjacent to trails.	Units 5780, 5420, 5410
80	To minimize visual impacts	Work with recreation specialist during layout phase to mitigate potential impacts to scenery.	Units 150, 160
	Inventoried Roadless Areas		
81	Maintain integrity of IRA	Units adjacent to IRA will have boundary markers established during implementation to ensure all project activities are restricted to areas outside the IRA boundaries.	5120, 5130, 5140, 5320, 5370, 5380, 5400, 5410, 5420, 5440, 5470, and 5800.
	Fire and Fuels		
82	To reduce post-harvest fuels	Follow Forest Plan Standards and Guides for prescribed burning S&G FW-252.	All harvest units
83	To maintain effective ground cover and downed wood following fuels treatments	Follow Forest Plan Standards and Guides for prescribed burning S&G FW-081 and FW-253.	All harvest units
84	Identify management objectives in the forest plan, related to fuels, prescription parameters, contingency, safety hazards and mitigations, and public notification	Use the nationally approved Interagency Prescribed Fire Burn Plan for any activity involving prescribed fire.	All harvest units
85	Maintain forest structure and wildlife objectives	Follow burn prescription parameters, overstory mortality should not exceed 10%.	Underburn units
	Air Quality		
86	To monitor and control air quality in communities and Class 1 Airsheds	Follow Oregon Smoke Management Plan and Forest Plan Standard and Guides.	All harvest units

	Objective	Design Feature	Location
87	Approve burning of units/piles given current conditions and monitor smoke during prescribed burn/pile burn	Survey fuels for estimate of particulate matter and obtain approval from ODF Smoke Management Forecaster.	All harvest units

2.7 Mitigation and Enhancement Recommendations Common to Alternatives 2 and 3

Table 10 provides a list of mitigation and enhancement recommendations for wildlife trees and down wood common to Alternatives 2 and 3. Shaded units have high treatment priority due to land allocation, Critical Habitat, proximity to spotted owl, other wildlife high use area, or Riparian Reserves that currently lack snags and large down wood. Units proposed for regeneration harvest would have snag/large down wood creation as a mitigation measure (units shown in bold font). Some units have habitat mitigation measures recommended in riparian reserves. Other units have snag/down wood creation recommended as an enhancement measure and implementation is dependent on funding.

Table 10. Wildlife Tree and Large Down Wood Creation Recommendations for Alternatives 2 and 3

Unit	Land Allocation/Critical Habitat (CH)/other criteria	Snag Creation per acre	Large Down Wood Creation per acre	Unit	Land Allocation/Critical Habitat	Snag Creation per acre	Large Down Wood Creation per acre
40	AMA/owl core	5	5	1240	Matrix	2	2
41	AMA/owl core	4	4	1290	Special Interest Area – Hidden Lake	2	2
60	AMA/low snags	2	1	1310	Special Interest Area – Hidden Lake /CH	2	2
70	AMA/low snags	2	1	1320	Matrix/CH	3	3
80	AMA	2	0	1330	Matrix	0	2
130	AMA	2	2	1340	Matrix	0	2
140	AMA	2	2	1350	Matrix	2	2
150	AMA	0	0	1360	Matrix	2	2
160	AMA	1	1	1370	Matrix	2	2
200	AMA/low snags/owl core	4	1	1380	Matrix	2	2
220	AMA	2	2	1410	Matrix/CH	4	4
230	AMA	1	1	1430	Matrix/CH	0	3
240	AMA	1	1	1450	Matrix/CH	1	3
250	AMA	1	1	1490	Matrix/CH	0	2
260	AMA	0	0	1500	Matrix/CH	0	2
290	AMA	2	2	1540	Matrix/CH	0	2
300	AMA	2	2	1570	Matrix	2	2
310	AMA	1	1	1610	Matrix/CH	0	2
320	AMA	2	2	1830	Matrix/CH	5	5

Unit	Land Allocation/Critical Habitat (CH)/other criteria	Snag Creation per acre	Large Down Wood Creation per acre	Unit	Land Allocation/Critical Habitat	Snag Creation per acre	Large Down Wood Creation per acre
330	AMA	2	2	1840	Matrix/CH	5	5
350	AMA	2	2	1850	Matrix/CH	2	2
380	AMA	2	2	1880	Matrix/CH	4	4
390	AMA	4	2	1890	Matrix/CH	5	5
400	AMA	0	1	1910	Matrix/CH	3	3
410	AMA	0	0	1920	Special Interest Area – South Fork/CH	2	2
420	AMA	2	0	1930	Matrix/CH	2	2
430	AMA	0	0	1940	Matrix/CH	2	2
440	AMA	3	0	1950	Matrix/CH	2	2
500	AMA	1	0	1960	Matrix/CH	2	2
530	AMA	0	0	1980	Matrix/CH	2	2
580	AMA	1	0	5030	Matrix/CH	3	2
600	AMA	1	0	5040	Matrix/CH	3	3
610	AMA	2	0	5080	Matrix/CH	2	2
630	AMA	2	2	5090	Matrix/CH	2	2
640	Matrix	1	2	5120	Special Interest Area – Wildlife Habitat/CH	2	2
650	Matrix	0	0	5130	Special Interest Area – Wildlife Habitat/CH	0	2
680	Matrix	0	1	5140	Special Interest Area – Wildlife Habitat/CH	3	2
690	Matrix	2	0	5160	Matrix/CH	2	2
720	Matrix	2	2	5170	Special Interest Area – South Fork/Matrix/CH	0	2
740	Matrix	2	2	5180	Special Interest Area – South Fork/CH	2	2
750	Matrix	0	2	5230	Matrix/CH	2	2
760	Matrix	0	2	5300	Matrix/CH	2	2
770	Matrix	0	2	5320	Matrix	2	2
780	Matrix	2	2	5360	Matrix	2	2
790	Matrix	2	0	5370	Special Interest Area –Wildlife Habitat/CH	3	3
800	Matrix	2	2	5380	Special Interest Area – Wildlife Habitat/CH	3	3
820	Matrix	2	2	5390	Special Interest Area – South Fork/CH	0	2

Unit	Land Allocation/Critical Habitat (CH)/other criteria	Snag Creation per acre	Large Down Wood Creation per acre	Unit	Land Allocation/Critical Habitat	Snag Creation per acre	Large Down Wood Creation per acre
830	Matrix	2	2	5400	Special Interest Area – South Fork	1	2
840	Matrix/CH	2	2	5410	Special Interest Area – South Fork	2	2
850	Matrix	2	2	5420	Special Interest Area – South Fork	2	2
860	Special Interest Area- South Fork	3	0	5430	Matrix	0	2
890	AMA	3	3	5440	Matrix	2	2
980	Matrix	0	2	5450	Matrix	1	1
990	Matrix	2	2	5460	Matrix	3 in RR, 2 elsewhere	0
1020	Matrix	0	2	5470	Matrix	3 in RR, 2 elsewhere	2 in RR, 1 elsewhere
1030	Matrix	0	2	**5480**	Matrix	4	3
1040	Matrix	0	2	5510	Matrix	5	3
1060	Matrix	0	2	5530	Matrix	5	4
1070	Matrix	2	2	5710	Matrix/high snag levels adj.	1	2
1090	Matrix	0	2	5720	Matrix	4	4
1100	Special Interest Area – South Fork	2	1	5730	Matrix	4	4
1110	Special Interest Area – South Fork	2	1	5740	Matrix	2	1
1120	Matrix	0	2	**5770**	Matrix	4	4
1130	Matrix	3	2	**5780**	Matrix	3	3
1160	Matrix	2	2	5800	Matrix	4	1
1190	Matrix	2	2	5810	Matrix	2	0
1200	Matrix	2	0				

2.8 Monitoring

Operations: Contract administrators would monitor treatments during implementation to ensure contractors are in compliance with their contract. Contract elements monitored would include harvest specifications, bole damage to residual trees, down wood and snag retention, skid trail spacing and use of designated skid trails.

Fuels Treatments: The McKenzie River District fire and fuels personnel would monitor fuel loading during and following the fuels treatments. Fuels treatment results will offer data to use in the future.

National Aquatic Best Management Practice Monitoring: The National Best Management Practices Program provides a standard set of core best management practices and consistent documentation of the use and effectiveness of the practices. Post-implementation best management practices monitoring may include review of aquatic management zones, erosion prevention and control measures, cable and ground-based yarding operation effects, and site treatment.

Invasive Plant Monitoring: Monitoring for invasive plants for three years after the treatment is completed. Identified weed populations would be treated.

Forest Plan Implementation Monitoring: The Forest Supervisor's Staff performs annual project monitoring at each Ranger District and compiles the results in the yearly Forest Monitoring Report. Implementation of treatments from this project would be subject to Forest Plan Implementation monitoring. Other implementation monitoring elements may include temporary road decommissioning, snag and large down wood abundance, and any seeding or planting of vegetation.

Reforestation: Ensure regenerated stands are sufficiently stocked within five years. Forest Service Manual directs us to conduct first and third year stocking surveys to determine if the site can be certified.

Chapter 3 - Affected Environment and Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives.

Cumulative Effects Analysis

This section of the DEIS considers the environmental consequences of implementation of the various alternatives. The following discussion of effects follows CEQ guidance for scope (40 CFR 1508.25(c)) by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. For this analysis, in general, direct and indirect effects have been discussed in the context that most readers are accustomed to: those consequences which are caused by the action and either occur at the same time and place, or are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

The analysis of direct, indirect, and cumulative effects on each resource includes defined analysis area boundaries, as well as the length of time effects are expected to last. These are specific to each resource and therefore may vary in physical and temporal scale.

Interdisciplinary Team

The interdisciplinary team (IDT) includes Forest specialists for each discipline (Chapter 4, for team members and their qualifications). Specialists on the IDT prepared technical reports to address the affected environment and expected environmental consequences of the proposed actions and alternatives of the Green Mountain project. All reports are maintained in the project file, located at the McKenzie River Ranger District in McKenzie Bridge, Oregon. In some cases, this chapter provides a summary of the report and may only reference technical data upon which conclusions were based. When deemed appropriate, those parts of specialist reports that are not included in this DEIS are incorporated by reference (40 CFR 1502.41).

Role of Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the IDT specialists. The conclusions of the IDT specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of this DEIS. Referenced material is a consideration of the best available science.

Cumulative Effects

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

Appendix F provides a summary of past, present, and reasonably foreseeable activities in the project area that could contribute potential cumulative effects to the environment along with the Green Mountain project.

3.1 Forest and Stand Structure

3.1.1 Scale of Analysis

The scale used to evaluate direct, indirect and cumulative effects on Forest and Stand Structure associated with the Green Mountain project is the project area. The project area consists of 99,051 acres within the Cougar Reservoir - South Fork McKenzie River (SFMR), Rebel Creek - SFMR, Augusta Creek - SFMR, Roaring River - SFMR, and Elk Creek – SFMR 6th field watersheds. By using the project area, it is possible to evaluate potential impacts in an area large enough to encompass other disturbances, both human and natural, and it is a logical analysis area to assess stand conditions based on plant associations.

3.1.2 Affected Environment

The Green Mountain project area consists of approximately 99,051 acres along the South Fork McKenzie River within the McKenzie River Ranger District. The project area is composed mostly of a Douglas-fir and western hemlock overstory with an understory shrub component of vine maple, salal, dwarf Oregon grape, sword fern and Pacific rhododendron. There is a transition to the true fir/mountain hemlock zone above approximately 4,000 feet, most notably in the area east of Box Canyon.

Stand Age Classification

Stand age of Forest Service managed lands in the project area was determined using data from the Forest Service’s VEGIS database in addition to stand exam data collected 2010-2012. Data shows approximately 86,439 USFS managed acres as forested in the project area. Stand age in the project area is distributed into four categories: Stand Initiation, Stem Exclusion, Understory Re-Initiation, and Old Growth.

Stand Initiation - Young Managed Plantations (0-30 years old)

Stands in this category are the younger second growth plantations originating from regeneration harvest which took place in this area in the late 1980's and 1990's. These stands are in the stand initiation development stage as described in Oliver and Larson (1996). Most stands were re-established by planting conifer seedlings after the regeneration harvest at stocking level to ensure survival of fully stocked sites. Other plants – trees, shrubs, and herbs grow from seed, sprouts, advance regeneration, and other mechanism are also invading the sites and compete for the open growing space. Growth is usually rapid with competition for the available growing space. Generally, these stands have low to moderate amounts of downed woody debris and standing snags. Stand initiation represents approximately 4,041 acres, or approximately 4.7 percent of the forested lands administered by the Forest Service in the project area (Figure 14).

Stem Exclusion - Second Growth Plantation (31-80 years old)

Stands in this category are the older second growth plantations originating from early clearcut harvest treatments in the 1940's to the early 1980's and wildfires in the early part of the decade (see Fire and Fuels Section). This stand type can be characterized as a dense, closed-canopied, even-aged stand. Based on the stand development classifications developed by Oliver and Larson (1996), these stands are classified as stem exclusion. The stem exclusion stage occurs after canopy closure, as the stand begins to differentiate into size classes and shading and competition for nutrients and water by larger trees leads to death of smaller trees and much or all of the understory vegetation. Some of timber stands established after wildfires have a scattered overstory of remnant old–growth. Past logging utilization practices, fuels treatments, and safety regulations governed the amount of downed woody debris and standing snags retained in the plantations. Generally, these stands have low to moderate amounts of downed woody debris and are absent of standing snags. Stem exclusion represents approximately 10,956 acres, or 13 percent of the forested lands administered by the Forest Service in the project area (Figure 14).

Understory Re-initiation - Mature (81-180 year old)

Stands in this category are characterized as a fairly uniform, single-canopied, even-aged stand. These stands are in the understory re-initiation development stage. During the understory re-initiation stage, crown recede and scattered overstory trees begin to die, and herbs, shrubs, and tree regeneration (usually shade tolerant species such as western hemlock, western red cedar, and true firs) appear on the forest floor. Many of these stands originated from wildfires that occurred in the late 1800s and early 1900s. The lack of legacy structural components such as snags and coarse downed woody debris left over from the previous stands suggest a fire regime of re-burns or multiple underburns fires over the last 2 centuries. Understory re-initiation represents approximately 41,318 acres, or 48 percent of the forested lands administered by the Forest Service in the project area (Figure 14).

Old Growth - Old Growth (greater than 180 years old)

Stands in this category are characterized as old growth (Oliver and Larson, 1996) and would generally meet the definition of old growth, and in some cases the PNW-447 (USDA, 1986) old growth criteria. The stands have large, live trees, often dominated by seral Douglas fir; large, dead, standing and downed trees; multi-layered canopy; and a heterogeneous understory. The old-growth stage occurs when overstory trees die sporadically and understory trees begin growing into the overstory, creating multiple canopy layers and gradual shift towards a stand dominated by tolerant species. Many of these stands have been previously salvage logged to remove wind throw and mortality. Old Growth represents approximately 29,839 acres, or 34 percent of the forested lands administered by the Forest Service in the project area (Figure 14).

Figure 14 illustrates the current stand age classifications in project area and Table 11 provides the acreages of each stand age classification and the acres proposed for harvest in each category by alternative.

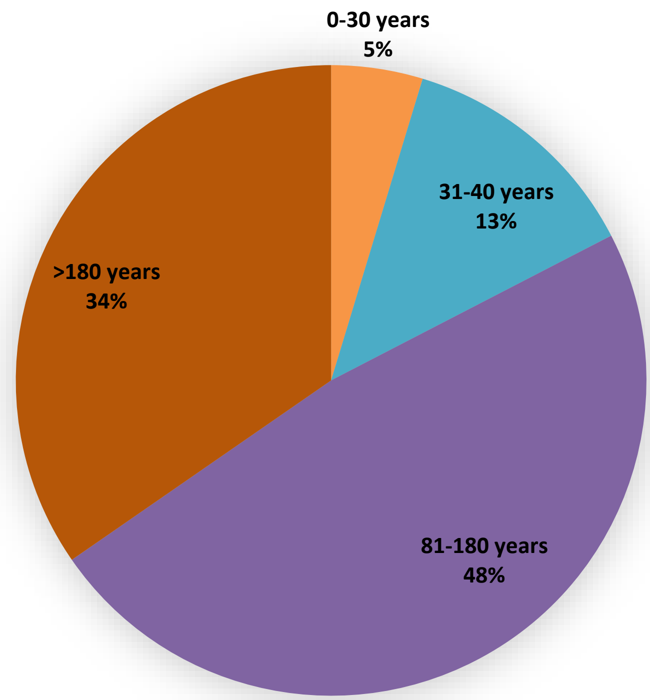


Figure 14. Current Stand Age Classification in the Green Mountain Project Area

Table 11. Harvest Units by Alternative and Stand Age Classification

	Stand Initiation (0-30 years old)	Stem Exclusion (31-80 years old)	Understory Re-Initiation (81-180 years old)	Old Growth (>180 years old)
Project Area[1] (acres)	4,041	10,956	41,318	29,839
Alternative 2 (acres)	316	3,641	441	0
Alternative 3 (acres)	316	3,641	0	0

[1]: Does not include non-forest areas such as waterbodies, meadows, and rock outcrops. Also does not include private land.

Stand Vigor and Growth

Stand Density Index

Harvest is proposed in both previously managed stands and fire regenerated (naturally regenerated) stands. Eighty-three percent (Table 13) of stands proposed for harvest, both managed stands and fire regenerated, in the project area are second growth stands classified as being in the stem exclusion development stage (Oliver and Larson, 1996). Stands in this stage have dense crowns which block out the light to the forest floor and limit additional tree regeneration in the understory. Shade-tolerant understory trees that are present persist but grow very slowly. Intermediate or suppressed trees that do not tolerate shade well suffer from competition and have an increased mortality rate.

Stand vigor and growth is declining in these stands. Some trees have begun to die due to overcrowding and competition between trees for nutrient and light as evidenced by competition-induced mortality. The Stand Density Index (SDI), which is a qualitative measure of tree competition within a stand, ranges from 209 to 582 and averages 380 for all stands being considered for treatment in the Green Mountain project area. In Douglas-fir, the maximum SDI (SDImax) is 595 (Reineke 1933). Using SDI helps translate current conditions to future objectives, such as reduced competition to maximize individual tree or stand growth. As a stand reaches an SDI of about 149, or approximately 25 percent of SDImax, trees within the stand start to compete with each other. As SDI increases to around 357, or 60 percent SDImax, trees reach a point at which they start dying due to competition, or self-thinning (Long, 1985). Lower SDImax numbers are more suited to maximize individual tree growth, while harvesting when SDI reaches around 208-238, or 35-40 percent SDImax, the stand as a whole would have maximum growth.

Age of the stands play a role in the stand development both in fire regenerated stands and previously managed stands, however it is not the sole factor. Because other factors such as climate/microclimate, soils, and water availability “are fundamental to site productivity – the potential for a site to produce plant biomass” (Tappeiner 2007 pg. 37) age alone does not tell much about the stands development. Stands with favorable climate, soils and water availability will in a shorter period of time grow larger diameters and heights compared to those stands with less favorable climate, soils and water availability.

Existing stand conditions were quantified using 2010-2012 stand exam data. The April 2014 version of Forest Vegetation Simulator (USDA Forest Service 2008, Pacific Northwest model with Western Cascade variant, revised April 2014) was used to analyze stand data. In addition, Gradient Nearest Neighbor, or GNN data was used to develop the existing landscape age classes, because modeling with nearest neighbor creates only slight differences for ecological systems according to Ohmann et al. (2011).

Previously Managed Stands

Approximately 3,957 acres of previously managed stands are proposed for treatment in the Alternative 2. Over about the last 70 years there has been approximately 17,979 acres of timber harvest on lands managed by the Forest Service in the project area. Approximately 8,225 acres of Forest System lands in the project area have been precommercially thinned. Approximately 13,823 acres of Forest System lands in the project area were modified with regeneration-type timber harvest, which is now in plantations less than 60 years old.

In previously managed stands, the average age of the stand is 37 years old with the range between 26 and 72 years old. Many of the stands are just starting to enter the stem exclusion stage or are already well in the stem exclusion stage with SDI’s averaging 373. Little understory development and species diversity appears to be in the stands. Many of the existing plantations in the analysis area are becoming ready for intermediate thinning treatments. Over the next decade, tree diameters in younger plantations will continue to become large enough for commercial thinning.

Fire Regenerated Stands

Approximately 441 acres of fire regenerated (naturally regenerated) stands are proposed for harvest in Alternative 2. The project area has been shaped by wildfires over the last several centuries, as well as timber harvest over the past 100 years. In the Augusta Creek study (USDA 1998, pg. 9), which looks at only the Augusta Creek portion of the project area, 26 stand replacing fire events occurred over about a 450 year period, burning on average 1,624 acres with many areas burned multiple times. Many, but not all fire-regenerated stands in the analysis area show signs of active management. Some fire-regenerated stands have residual stumps representing either past salvage logging or selective harvest. The project area includes fire-regenerated stands which have been thinned in previous entries, as well as some stands that have not been previously thinned.

In the fire regenerated stands proposed for treatment, the average age is 118 years old with a range of 90 to 144 years old. Because the majority of these stands are within the stem exclusion stage, only small amounts of understory development is apparent as the stands have started competition mortality. The fire regenerated stands proposed for harvest in the Green Mountain project have an average SDI of 427 (Table 14) which is 72 percent of maximum SDI.
Stands Over 80 Years of Age

Table 12 illustrates average stand characteristics of previously managed, fire regenerated, and an average of all stands proposed for harvest in the project area.

Table 12. Average Stand Characteristics of Stands Considered for Harvest

Stand Type	Total Trees Per Acre	Trees per acres available for harvest[1]	Quadratic Mean Diameter[1]	Average Stand Height[1]	Canopy Cover Percent[1]	Average Age[1]	Basel Area[1]	Stand Density Index
Managed	920	201	14	84	70	37	202	373
Fire Regenerated	824	102	22	106	62	118	260	427
All	908	189	15	87	69	47	209	380

[1]: Based on trees seven inches and greater DBH, because seven inches is the minimum DBH of a tree considered for harvest in the Green Mountain project.

3.1.3 - Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Stands left untreated would continue for another 200-500 years baring a natural disaster, but at slower rates as trees compete with each other for growing space. Growth rates would continue to decline, and natural processes that affect tree vigor and cause changes in stand structure would continue. The effects of overstocked stands include decreased growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. Diameter growth would be low or would decline, and live crown ratios would get smaller. Trees within these stands would become less vigorous and more susceptible to insects and diseases. Competition-induced mortality would increase, thus increasing small diameter <15” snags and down wood. The down material would increase fuel loadings, fire risk and vulnerability of the stands to insect infestations. The competition-induced mortality would not be available for commercial wood products. Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation. The diameter and product value of trees harvested in the future would be reduced without treatment. The no action alternative would result in no compaction and potential loss of growth along temporary roads.

The current shortage of early seral habitat for wildlife species would continue to decline (see Figure 25). Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation. Decline in underrepresented species, like sugar pine (*Pinus lambertiana*) and western red cedar (*Thuja plicata*), would continue. Shade tolerant species, like western hemlock, would eventually dominate the stand in absence of timber harvest and/or other disturbances. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir and sugar pine. The diameter and product value of trees harvested in the future would be reduced without treatment.

Alternative 2 and 3

The following treatments are used to describe the direct and indirect impacts for treatments that would occur with both action alternatives.

Thinning

Thinning would increase the health and vigor of the remaining trees and help increase the stands ability to adapt to environmental changes. Additional light, from reduced canopy cover, reaching the forest floor would help promote a second cohort of trees. Both shade-tolerant and intolerant species may be established; however, shade-tolerant species would thrive better over time as the overstory crown closes. The beneficial effects of a more open canopy would taper off over the next 15-20 years as the canopy cover is estimated to increase 2 percent per year (Chan 2006). This second cohort is expected to provide vertical, horizontal, age, and species diversity in the stand by primarily harvesting Douglas-fir which is over represented in the project area because of planting densities.

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees with an emphasis on retention of sugar pine and white pine; however these species may be cut for operational purposes (Figure 15). This prescription would also maintain or increase vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Young uniform stands can be diversified by early thinning (DeBell et al 1997, and Hayes et al. 1997) as proposed for the plantations to be treated with the Green Mountain Project. Early commercial thinning has been shown to be beneficial to the future development of understories, the promotion of natural regeneration, and in enhancing biodiversity (Muir et al 2002). With early thinning, overstory trees can develop deep canopies and large-diameter branches in open stands (McGuire et al 1991). Low overstory density facilitates the establishment of understory trees (McGuire et al 1991, Bailey and Tappeiner 1998, Miller and Emmingham 2001).

Heavier thinning would likely promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. Many old trees grow rapidly when they are young (30-100 years), producing large stems and crowns. Evidence (Franklin et al 1981, Tappeiner et al. 1997) suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition. Old-growth stands typically have multiple canopy layers, and thinning promotes a second cohort by allowing for natural regeneration to occur (Tappeiner et al. 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established tolerant conifers (Winter et al 2002a 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

A short-term adverse effect to understory vegetation and below ground fungi would be the mechanical damage from logging. The removal of host trees and soil disturbance from the yarding operation impacts below ground fungi (Courtney et al 2004). This adverse effect is mitigated by the use of designated skid trails with ground –based yarding systems and log-suspension capabilities of skyline and helicopter yarding systems.

Figure 15. Visualization of Stand Before (left side) and After (right side) Thinning

Gaps

Gaps are openings which would range in size from one to three acres outside of Riparian Reserves and up to ¼ acre within Riparian Reserves (Figure 16). Gaps would be randomly placed unless it was necessary to strategically place the openings to minimize conflict with logging systems, to minimize visual concerns, or to treat an identified root rot pocket. Within the stand, a thinning prescription would be applied to the area outside the gaps.

Gaps outside of Riparian Reserves would retain up to four trees per acre, with five trees per acre retained in Riparian Reserves to add diversity and provide for natural recruitment of snags and down woody material in the future. Trees designated as a leave tree within the gap would not be used for snag or large down wood enhancement projects. Retention trees meeting criteria for wildlife trees (i.e. having *Phellinus pini* conks or other elements of wood decay, crooked tops, etc.) would serve as a wildlife tree and offset the need for enhancement. Additionally, non-commercial small, approximately 1/8 acre gaps would be placed along streams to encourage light to the streams for increased primary productivity and in-stream wood. Refer to Section 3.4 – Aquatic Resources for additional information.

By implementing gaps, the project would provide numerous benefits for many species of wildlife over the next 10-20 years before regeneration reclaims the opening. For birds, gaps have been shown to provide habitat to shrubland birds not present in mature forest (Chandler et al. 2009) while generally providing more fruit and more resource abundance due to a lower canopy and increased fruiting (Blake and Hoppes. 1986). Generally, with gaps, provide more resources to herbs, shrubs, and broad-leaved plants which provide the foundation for food webs that contribute to many different trophic levels in Pacific Northwest conifer forest (Hargar, 2007).

Figure 16. Visualization of Thinning with Gaps

Dominant Tree Release (DTR)

This prescription would provide for growth of a dominant tree or group of five to ten trees to promote larger trees scattered throughout the stands. This meets the purpose of improving stand conditions in terms of species composition, diversity, density, and structure. DTR may result in open grown trees that develop larger limbs lower to the ground, which could serve as wildlife habitat (McGuire et al 1991), as well as greater taper, reducing tree susceptibility to wind damage in the future. The area around the dominant tree would be cut to a radius of 66 feet from the bole of an individual tree, or each tree in a group. Around an individual tree, the 66 feet equates to approximately ¼ acre when one tree is identified. When five to ten trees in a clump are identified, the opening size would vary depending on the number and spacing of trees retained but would likely range from an estimated 1/3 to ½ acre (Figure 17). Sugar and white pine over 24” in size would be treated as a dominant tree. The lack of competition will provide the tree(s) in the DTR a long term benefit of at least 50-100 years as it will remain a dominant tree in the opening even as other trees encroach on the opening.

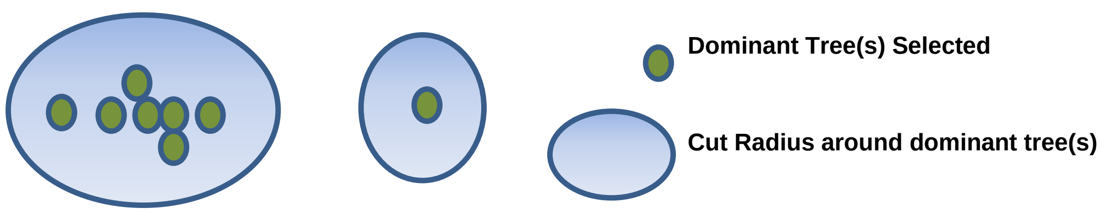


Figure 17. Visualization of Single vs Multiple Tree Dominant Tree Release

Regeneration Harvest - Shelterwood with Reserves (Alternative 2 Only)

Many of the stands proposed for regeneration harvest have not reached culmination of mean annual increment (CMAI), meaning a point at which a stand’s growth has reached its maximum annual increment and starts to decline (Society of American Foresters 2008). Typically, regeneration harvest is limited to stands that “Generally have reached CMAI,” which is defined as “the age required to achieve volume production equivalent to at least 95 percent of CMAI as expressed in cubic measure” (USDA 2006a). However exceptions are allowed when the harvest is driven by other resource objectives (USDA 2006a, 36 CFR 219.11(d) (7)) and when a project level analysis is performed with public disclosure (USDA 2006b). Additionally, the Willamette Land and Resource Management Plan’s Forest-Wide Standard and Guideline, FW-182 allows for harvest when stands have not reached 95 percent CMAI “…where special resource considerations require earlier harvest (36 CFR 219.16(a)(2)(iii))”. The Green Mountain project aims to address the lack of age and structural diversity in the project area because early seral habitat is of key importance to an estimated 156 species of wildlife in the central Oregon Cascades (O’Neil et al 2001).

In an effort to balance the needs of the Norther Spotted Owl Critical Habitat (CHU), and the need for increased age distribution and structural diversity, the Green Mountain project proposes regeneration harvest in stands that have and have not reached 95 percent CMAI outside of the CHU. Currently, the 40-80 year old age class represents about 9 percent (Figure 4) of the project area, while according to the Augusta Creek Study (USDA 1998); approximately 11 percent (Figure 5) is more representative of a historic percentage based on fire regimes. Conversely, the 0-15 year age class is currently less than one-tenth of a percent (Figure 4) compared to about 7 percent historically (Figure 5). By including regeneration harvest in approximately 3 percent of the stands in the 40-80 years old class; the Green Mountain project would increase acreage of an under represented age class (0-15 years old) while also helping to assure a sustainable supply of timber products in the future. Over the next 10-15 years, the younger age classes (0-15, and 15-39) will help balance the age classes in the project area to better represent the historic age distribution (Figure 5). When a benchmark, such as moving an existing age distribution to a more desirable historic distribution is established and analyzed to meet other resource needs, an alternative to CMAI may be evaluated (USDA 1992).

Approximately 325 acres would be treated with a regeneration harvest, of which approximately 253 acres are less than 80 years old, and 72 acres are over 80 years old. The majority of trees would be removed with some residual live trees left on site. Although not exactly mimicking naturally occurring disturbance events, this harvest would provide a forest products while creating a small-scale disturbance in the analysis area somewhat similar to what may have occurred naturally. The objective would be to leave approximately 25 trees per acre following harvest to help establish a future stand by providing a beneficial microclimate, and contribute towards creating snags and down wood (Figure 18). Those residual trees not used for snag and down wood creation would be retained throughout the rotation. The residual trees would on average be larger trees including some with disease to promote natural processes. These residual trees would provide for future snag development, and down woody material to provide diversity in the future stand structure.

Figure 18. Visualization of Shelterwood with Reserves Pre (left side) and Post (right side) Treatment

Even-aged systems provide an optimal seedling environment for the establishment and growth of the shade intolerant species presently on site. The residual live trees are used to provide seed and/or protection from environmental extremes. The residual green trees are well-dispersed through the unit to provide a consistent level of protection. Planting will be used to help regenerate the stands (see Connected Actions below), with a precommercial thin (PCT) planned for 15 years later, and commercial harvest 25 years after the PCT.

The residual canopy would be composed of the largest trees in the stand, primarily Douglas-fir. At least 15 percent of each stand would be retained in no-harvest patches to provide diversity and maintain existing snags (NWFP 1994 C-40). The retained patches would be scattered and variable in size. Stands treated as regeneration harvest would be treated for fuels reduction, and planted with a variety of tree species after harvest. Large wood on the forest floor would be maintained or enhanced. Numerous snags would either be maintained on site if not a hazard to logging operations, or enhanced through snag creation techniques.

No Harvest – Skips

By not treating an area, the area would provide diversity within a stand. These areas would be allowed to have natural processes take place such as inter-tree competition, which would create snags and down woody material. However, there would be an edge effect that could take place along the skips edge. Skips would be dispersed between riparian and non-riparian areas. Depending on the location and positioning of the skip, the edge effect could allow for more light to reach the trees along the edge and forest floor. This extra light could lead to greater growth of some of the individual trees, forbs, and shrubs along the edge.

Implementation of skips would be with hard boundaries flagged on the ground along unit boundaries and within units. Additionally, internal skips may include identifying a tree and not including for harvest any other tree within a specified distance of that identified tree. Similar to the no action alternative, skips would continue for another 200-500 years baring a natural disaster, but at slower rates as trees compete with each other for growing space and resources.

Comparison of Effects from Alternative 2 and 3

Both action alternatives would have the same beneficial effects previously identified on treated acres (Table 15). However, Alternative 3 would harvest fewer acres which would results in fewer treatment benefits, as identified above in the direct/indirect effects section, compared to Alternatives 2. Alternative 3, by treating fewer acres would result in more acres showing signs of no treatment such as explained in the Alternative 1 section of the direct/indirect section above.

Alternative 2 would use thinning and dominant tree release (DTR) on 2,646 acres; about two percent fewer acres than the 2,696 in Alternative 3, to improve or maintain growth and health of overstocked stands currently in stem exclusion. Thinning and DTR would open up the tree canopy allowing more sunlight and precipitation to reach the forest floor. This would result in changes in the microclimate (increased air and soil temperatures, relative humidity's, and air movement), under the main canopy for a short term (10-20 years) until the canopy closes back in (Chan, 2006). These changes in microclimate stimulate an increase in favorable growing conditions for most plant species.

Alternative 2 would treat 2,966 acres with thinning, DTR, and gaps to promote the development of a diverse, multi-layered stands, virtually the same as Alternative 3 which would treat 2,957 acres. The treatments would primarily aid by providing conditions that favor the establishment of shrubs, hardwoods, and conifer in the understory, and by releasing saplings and intermediate-crown class trees in the stand. Thinning, DTR, and gaps would also promote crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in open stand. As the crowns differentiate, the risk of a fire spreading from crown to crown goes down.

Thinning, DTR, gaps, and skips would maintain or enhance stand level, plant species diversity, composition and structure on 3,957 acre in Alternative 3, or approximately three percent fewer acres than 4,073 associated with Alternative 2. Species richness for herbaceous species and total species richness across trees, shrubs, and herbaceous vegetation were greater in thinned stands than in un-thinned and old-growth stands (Bailey et al 1998).

Moving acres into stand initiation is accomplished more with Alternative 2, where Gaps, DTR, and regeneration harvest would provide for 936 acres, or over twice the acres compared to 467 for Alternative 3. Those acres would provide for long term (80-100 years) sustainable timber production.

Through commercial harvest, fuel loading would increase on 2,957 acres with Alternative 3, compared to 3,291 acres associated with Alternative 2. The fuels added would mostly be smaller in size from limbs and needles which typically decompose within 2-3 years. Increased growth of the understory would provide a more contiguous bed of green, high moisture content, less flammable vegetation on the forest floor. Please see the Fire and Fuels section for more information on fuel loading.

Commercial harvest may cause some stages of forest succession to be shortened due to accelerated growth and enhancement activities (Andrews, et al 2005). These stands would more quickly move from stand initiation to understory re-initiation and on to old growth.

Table 13 compares the acreages proposed for treatment in each alternative.

Table 13. Comparison of Treatments (acres) by Alternative

Treatments	Alternative 1	Alternative 2	Alternative 3
Acres of Thinning Outside Riparian Reserves	0	1,454	1,596
Acres of Thinning Within Riparian Reserves	0	901	894
Acres of Regeneration Harvest	0	325	0
Acres of Gaps	0	320	261
Acres of Dominant Tree Release	0	291	206
Acres of Skips Outside Riparian Reserves	0	346	253
Acres of Skips Within Riparian Reserves	0	761	747
Total Acres of Timber Harvest Units (includes skips)	**0**	**4,398**	**3,957**

Cumulative Effects

Alternative 1

With implementation of Alternative 1, no cumulative effects to forest stand and structure would occur as the effects of Alternative 1 do not overlap in space and time with effects from any past, present or reasonably foreseeable future actions.

Alternative 2 and 3

Effects to forest stand and structure from Alternatives 2 and 3 overlap in time and space with effects from three past projects – Cascade Thin, Hartz Reoffer Thin, and Road 19 Salvage. The Cascade Thin Project was completed in 2013 and treated approximately 56 acres including approximately ten acres of gaps. Harvest was completed on Road 19 Salvage in 2014, which include harvest of approximately 120 trees adjacent to Road 19 which posed a hazard to the road. Hartz Reoffer Thin, completed in 2015, treated approximately 115 acres with thinning similar to that of the Green Mountain project. Hartz Reoffer Thin also contained about 430 acres of thinning west of the project area, which is not considered in this analysis.

Effects to shift age class diversity (acres move back to stand initiation) on the landscape from activities associate with the Green Mountain project would have a beneficial cumulative effect by increasing the acres in the 0-30 year age class. By adding Green Mountain's acres to the acres of gaps associated with Cascade Thin (10 acres), Green Mountain would cumulatively increase the acres of forest in the stand initiation stage within the project area to 946 and 477 acres for Alternatives 2 and 3 respectively.

In conjunction with Cascade Thin, and the Hartz Reoffer Thin the Green Mountain project would cumulatively benefit the project area by helping to maintain or enhance plant species, increase structural diversity and composition, and promote crown differentiation. Cumulatively, the project would have beneficial effects on 4,569 and 4,128 acres for Alternatives 2 and 3 respectively.

When looked at with Cascade Thin, and the Hartz Reoffer Thin, treatments associated with Green Mountain would reduce the time 3,462 and 3,128 acres for Alternatives 2 and 3 respectively are in the stem exclusion stage of stand development, which would limit the number of snags attained through suppression mortality on those acres. Additionally, the Road 19 Salvage has removed approximately 120 trees (snag/hazards to the road) which resulted in a small reduction in the number of existing snags.

No cumulative effect to fuel loading is anticipated because of the lag in time from harvest associated with the Green Mountain project. Fuel treatments on the Cascade Thin, Hartz Reoffer Thin, or Road 19 Salvage project will be complete on these projects prior to the implementation of Green Mountain.

Connected Actions

The following actions and effects would occur with implementation of both Alternative 2 and 3.

Post-harvest Tree Planting

Reforestation would be required in both Alternatives. Reforestation would be expected to occur within five years of harvest, and occur from both tree planting and natural regeneration, (Table 14). Alternative 2 would require approximately 644 acres associated with regeneration harvest and gaps, while Alterative 3 would require approximately 261 acres associated with gaps. Post-harvest densities would be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity with the ingrowth of species such as western white pine and western red cedar. Slash and other debris would be utilized as shade and as a deterrent to browse by ungulates. Planting in identified root rot pockets would be species that are less susceptible to root rot like western red cedar, sugar pine, white pine or red alder. Reforestation would help to ensure sustainability of the stands into the future. An increase in species diversity in the planted stands would result as a mix of species which represent historic species composition would be planted.

Table 14. Acres and Mode of Regeneration by Alternative

	Shelterwood w/ Reserves	Gaps		
	Planting	Natural Regeneration	Planting	Total
Alternative 2	325	190	130	645
Alternative 3	N/A	208	53	261

Creating Snags and Down Wood

Approximately five snags per acre would be created from the reserved trees in units with regeneration harvest in Alternative 2. In addition, at least 240 linear feet of down wood would be retained or created in decay classes 1 and 2. Enhancement opportunities would occur in thinned stands.

Subsoiling

Subsoiling would occur when a unit has compaction levels above Forest Plan Standards and Guidelines. Subsoiling is beneficial to Forest and Stand structure because of reduced compaction and root growth, so increased growth is likely along skid trails and landings that have subsoiling. Skid roads in planting areas are expected to be subsoiled to a depth of 18-22 inches to reduce the effects of compaction with the exception of soils under a retention tree canopy because the roots of the given tree would be less disturbed. Compaction from skid roads has not shown a reduction in residual tree growth (Miller et al, 2007). Some adverse effects may occur if residual trees inadvertently have roots pruned by the subsoiling.

Temporary Road Construction and Decommissioning

Temporary road construction and decommissioning would occur where temporary roads are necessary to facilitate project activities. The initial effects of the construction would be compacted soils which could affect Forest and Stand Structure; however those effects would be offset by decommissioning. The effects of decommissioning would be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction and root growth, so increased growth is likely along skid trails and landings that have treatment. Some adverse effects may occur if residual trees inadvertently have roots pruned during decommissioning.

Fuels Treatments

Fuels treatments will be discussed in Section3.14. A benefit of the fuels treatment to the Forest and Stand Structure is that when fuels treatments are complete, the likelihood of a reburn in the event of a wildfire is reduced. Also, when the selected fuels treatment is an underburn which is often in units which have regeneration harvest, and in unmanaged stands, a secondary benefit of exposing mineral soil. Mineral soils is proven to increase the survival of seedlings and the success of seeds to sprout and take root (Tappeiner, et all. 2007).

3.2 Soils

3.2.1 Scale of Analysis

For the soil resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the “unit”, i.e. the stand polygon or activity area proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the “unit” affected. The summing of acres for various units, such as the total acres of skyline logging in a given alternative, is not an evaluation criterion for soils impacts. Impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted.

3.2.2 Affected Environment

The Green Mountain project area lies primarily within the younger Western Cascade rocks and perhaps the oldest High Cascades sequences. More specifically, the basic rock strata in the project area are basaltic andesite and andesite lava flows, and flow breccias that represent younger events of the Western Cascade volcanic sequence. These volcanic units are mapped by Walker and Duncan (1989) as “Tfc” or “QTba”, and include strata of Miocene age of about 17 to 10 million years old (Walker and Duncan 1989).

The various land types are generally well drained where permeability is rapid in the surface soil and moderately rapid in the subsoil. Because of relatively fast infiltration rates, overland flow is generally uncommon. Additionally, slope instability is not a geologic process that is generally active in this project area. In the proposed units, side slopes range from near zero to about 30 percent on the gentler slopes to 40 to 80 percent on the steeper terrain. Off-site erosion is generally not a concern because of the vegetative ground cover, the high infiltration rates, and the gentle to moderate side slopes for many units.

Field investigation indicated that several areas within the Green Mountain project approached or exceeded the Willamette National Forest FW-081 Standard of 20 percent of activity area impacted by compaction (see Section 3.2.3 for specific units).

Most of this project area was burned by either natural or aboriginal fires that were likely prevalent and carried through much of the project area in the last several hundred years. Many areas may have been underburned instead of experiencing stand replacement fire events. Consequently, natural accumulations of downed woody debris may not have been prevalent in many parts of this project area. These conditions would vary across the landscape, depending on aspect, elevation, and slope position.

However because of the lack of sunlight to the forest floor, many of the stands proposed for treatment currently have little understory vegetation which is needed for nutrient and duff development. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas already compacted or disturbed by the initial entries, the soil building process is slowly returning the soil to near preharvest conditions.

3.2.3 Environmental Consequences

The major effects to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability (Table 15). The total area of detrimental soil effects should not exceed 20 percent of the total acreage within the activity area, including roads and landings.

Table 15. Management Indicators for Assessing Effects to Soils Issue Management Indicator Justification

Issue	Management Indicator	Justification
Displacement	50 percent of topsoil or humus enriched soil horizons are removed from an area of 100 square feet that is at least 5 feet in width	FW-081
Compaction	Increase in soil bulk density by at least 15 percent and/or a reduction in macropore space of 50 percent over the undisturbed soil	FW-081
Nutrient Loss	Insufficient duff retention or large woody material to ensure adequate nutrient cycling	FW-085
Instability	Increase in size, intensity or number of slope failures	FW-086

Direct and Indirect Effects

Alternative 1 – No Action

Previously harvested stands will continue to mature. Many of the stands proposed for treatment currently have little understory vegetation because of the lack of sunlight to the forest floor. This results in altered nutrient cycling. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas already compacted or disturbed by the initial entries, the soil building process would continue to return the soil to near preharvest conditions in the longer term (several decades). Short-term (within the first year or two) to intermediate-term (over 2-3 decades) impacts from harvest, such as soil disturbance, dust (or mud), slash accumulation and disposal, and longer term impacts such as compaction and nutrient loss would not occur. Slope instability is not a geologic process that is generally active in this project area. Consequently, no effects to slope instability are anticipated whether the units are managed or not.

Alternative 2 and Alternative 3

Effects between both action alternatives would be the same except for acreage harvested. The major short-term (the first year or two) impacts to soil productivity from harvest activity include displacement, compaction, nutrient loss, and instability. Forest-wide (FW) Standards and Guidelines (FW–081), state that the total area of cumulative detrimental soil conditions should not exceed 20 percent of the total acreage within the activity area, including roads and landings. In most situations, preventing soil impacts is the most effective and feasible way of reducing cumulative effects and ensuring long-term soil productivity. All prescriptions or design features discussed are designed to meet or exceed the requirements outlined in the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA, 2012).

Field investigation indicated that seven units approached or exceeded the Willamette National Forest FW-081 Standard of 20 percent of activity area impacted by compaction: 70, 610, 1500, 1930, 5120, 5130, and 5140. In addition, unit 1030 was higher than desirable, though not yet over the threshold. The remaining units were sufficiently within the standard. As mitigation in the units where compaction levels may exceed the 20 percent threshold at the completion of harvest activities, two actions are required: 1) Primary landings, temporary roads, or principal skid trails utilized by the purchaser/logger will be subsoiled (to a depth of 18 to 24 inches) at the completion of logging activities in units 70, 610, 1030, 1500, 1930, 5120, 5130, and 5140; and 2) the portion of units 5120, 5130, and 5140 downhill of Forest Road 1900425 would be cable yarded uphill to the existing road to keep Road 1900427 closed in order to minimize impacts to soils. In order to prevent future accumulation of impacts: 1) subsoiling landings and primary haul will be required to ensure that the overall levels remain well below the 20 percent standard; and 2) some post sale enhancement subsoiling for most ground based areas is recommended. Monitoring of post-harvest subsoiling on similar projects with similar activities, indicates overall compaction is reduced by 4 to 10 percent from initial levels. The recommended subsoiling method is by “munching” (lifting and breaking up compacted soil layers with an excavator) in order to reduce potential impacts from root pruning, to avoid concentrations of slash or down woody debris, and to reduce disruption from boulders or stumps.

One of the goals with entry into all the units is to provide the opportunity to subsoil the existing skid roads (legacy from past logging practices) as much as is practical in order to reduce compaction to lower levels. The objective is to remain below the 20 percent cumulative level, maintain long term soil productivity, and provide a level of erosion control that is consistent with Forest plan and State guidelines. With entry into any ground-based unit, evident skid or haul roads would be utilized before any new skid road is approved. All ground based yarding would require that either C6.41 and/or C6.42 (predesignated and preapproved skid roads) contract clause(s) on ground based portions be strictly adhered to, and/or line pulling and directional falling would be implemented, as appropriate.

Skyline operations in thinning units with small wood and intermediate supports usually impacts less than 1 percent of the unit area. Skyline yarding with one end suspension is proposed for parts or all of many units. Most of these units had low existing compaction levels at generally less than 5 percent, at least in the areas of steeper side slopes. Skyline landings are primarily planned at old existing landings, road turnouts, and road junctions. Some short temporary roads may be required. Consequently, effects from skyline yarding are not anticipated for any individual unit.

Also, temporary road construction will compact and displace approximately 52 acres and about 43 acres of soil will be disturbed in Alternative 2 and 3 respectively. However, all temporary roads will be decommissioned post-harvest by subsoiling as well as placing slash back onto the surface or re-vegetating with native grasses/trees. Temporary road construction and decommissioning results in some loss of soil structure that will partly recover over 10-20 years on these acres.

Potential nutrient loss is primarily controlled by duff retention standards. Duff retention is the amount of duff thickness remaining after management activities are completed. Duff retention objectives would be specified for each unit to maintain nutrient cycling. Duff retention values range on the low end from 10-30 percent to as much as 60 to 80 percent on sensitive slopes. Monitoring and field reconnaissance by the Forest Geologist in recent years has shown that the duff retention percentages for under burns in partial cuts, thinning, or fuels reduction within unmanaged stands, which maintain an intact live root mat and live canopy cover over most of the unit, could be lower and still achieve adequate soil protection.

For all action alternatives, within the managed plantations, slash would be scattered in the units, piled and burned, or perhaps broadcast or under burned. Piling may occur by hand or with a grapple machine. Grapple piling occurs with a grapple not with a dozer brush rake. Grapple piling requires only one pass of the machine across the landscape, and the machine works while sitting on slash. Extensive monitoring of grapple machine piling operations indicates that little or no additional compaction or displacement occurs, when properly implemented. In many cases only a few acres of any particular unit are hand piled or machine piled.

Burning the piled slash may develop sufficient heat to affect the underlying soil. However, the hotter portions of pile burning involve only a very small part of the acreage in any unit, usually less than 1 percent of the area. Also pile burning is usually done in the fall or winter months when duff and soil moistures are higher, and this helps reduce the downward heat effects to the soil. Consequently, pile burning is considered a minor effect and not cumulative because of the limited overall acreage involved.

Another aspect of long term nutrient availability and ectomycorrhizal formation is the amount of larger woody material retained on site. Management activities would be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling (FW-085). At this time, site specific needs would be considered commensurate with wildlife objectives as outlined in FW-212a and FW-213a (as amended). Concentrations of larger down logs that were produced with the initial harvest should be left undisturbed as much as possible. Consequently, with the retention of adequate duff and woody debris, potential adverse impacts to long-term (more than 4 decades) soil productivity are not anticipated.

Within this project, Units 390, 690, 820, 840, 890, 1040, 1090, 1240, 1320, 1340, 1350, 1360, 1370, 1380, 1490, 1500, 1540, 1840, 1940, 1980, 5060, and 5090 contain or border actively unstable or potentially highly unstable areas. Actively unstable or potentially highly unstable areas would be avoided with unit placement. Thinning is intended to enhance the growth and root development of leave trees which is important along the edges of unstable areas. With regards to Units 1540 and 1980, they contain areas of older, stabilized debris chute scars, where the failure originated outside the unit. Field review of previously thinned units in the past several years on both stable and unstable land types has shown no increase in either slope instability or erosion in either uplands or Riparian Reserves, when critical areas are avoided. Soils/Geology personnel may assist in the layout of some of these units, as needed.

Cumulative Effects

The primary previous impact to the soil resource from management is compaction, the effects of which can remain apparent for decades. Potential cumulative effects from displacement, nutrient loss, and instability with previous management were not observed in the field reconnaissance, or those units were dropped. Existing compaction levels have been documented and discussed for the various units. The impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted. The soils design features are designed to limit the amount of additional compaction, and the subsoiling is intended to reduce compaction where levels would exceed standards and guides. It is possible that some ground based units may approach or exceed the 20 percent standard at the completion of yarding, grapple piling, and pile burning. The objective is to remain below the 20 percent cumulative level, maintain long-term (more than 4 decades) soil productivity, and provide a level of erosion control that is consistent with State guidelines.

Prescriptions for soil protection and watershed considerations take into account past and predicted future land management activities. No single unit measure of long-term soil productivity is widely used.

Information on the survival and growth of planted seedlings may indicate short-term changes in site productivity. However, the relationship of short-term changes to long-term productivity is not fully understood. Experience indicates that the potential impacts on soils are best evaluated on a site-specific, project-by-project basis. The major soils concerns—compaction, nutrient loss, displacement and instability—are most effectively reviewed for short- and long-term effects at the project level. With proper project implementation, unacceptable cumulative effects on soils are not anticipated from the action alternatives.

3.3 Hydrology

3.3.1 Scale of Analysis

Unless otherwise noted, the geographic scale used to assess direct, indirect, and cumulative effects to water quality and aquatic resources for this project includes the project area units, the project area, the Elk Creek, Augusta, Roaring, Rebel, and Cougar Reservoir 6th Field sub-watersheds (Figure 19).

3.3.2 Assessment Methodology

Data on current and historic watershed condition was gathered from the South Fork McKenzie Watershed Analysis and through GIS analysis of a USFS vegetation database (FSVeg) and high resolution satellite imagery (WorldView2). Please refer to Appendix G and H for additional information.

At the beginning of the project all potential units were surveyed by fisheries, hydrology, wildlife, and botany specialists. Each unit was gridded to capture streams, springs, wetlands and other waterbodies that may not be mapped on the GIS layer. When waterbodies were found, they were mapped with GPS devices all the way through the unit and down to their terminus with another waterbody. Notes on each waterbody commonly include, but are not limited to: stream class and presence of fish, stream width, dominant substrate, stream gradient, surface connection (or lack of) to another waterbody, size and abundance of functioning large woody material (LWM) in channel (i.e. forming pools, retaining sediment), and characteristics of adjacent riparian stand (e.g. diameter of trees, amount and diversity of understory vegetation, amount of hardwood species).

Based on stream and riparian characteristics, a recommendation was made for no-treatment buffers and other potential treatments (e.g. down wood creation) for each waterbody. After surveys were conducted individually, fisheries, hydrology, wildlife, and botany specialists met as a team to discuss findings and come up with an integrated Riparian Reserve management plan for each unit. Refer to Appendix G for unit by unit information on Riparian Treatments.

3.3.3 Affected Environment - Riparian Conditions

Most of the Green Mountain project area is located in the older West Cascades geologic region. However, a portion of the project area drains the gently sloping terrain of the High Cascades which has a large water storage capacity that contributes to a stable, even flow regime. There are 2 portions of the project area dominated by earth flow terrain. The largest is found throughout most of the Rebel Creek 6th field subwatershed. Pocket wetlands and their characteristic vegetation can be found in this terrain. Most of the tributaries to the South Fork McKenzie River are moderate to high gradient (> 2 percent) first to fifth order streams. Boulders and large wood are key components found in these types of step/pool channels

Primary streams within the project area include the South Fork McKenzie River, Elk Creek, Roaring River, Augusta Creek, Grasshopper Creek, Loon Creek, Starr Creek, Hardy Creek, Buoy Creek, Ridge Creek, Rider Creek, and Boone Creek. Figure 19 shows the location of the major streams within the project area and the sub-watersheds. The 1964 and 1996 floods had complex effects on stream channels and riparian areas. Evidence of channel aggradation, bank failures, diverted channels, and altered riparian areas can be seen throughout the project area. In recent years, the channel conditions have been relatively stable.

The project area has also been shaped by fires as well as timber harvest within the last 100 years.

Records indicate 316 fires occurred in the Green Mountain project area from 1970-2013. Due to fire suppression, most fires were suppressed at less than five acres within a few days of ignition. Multiple researchers collected past fire data in and near the project area and categorized the fire regime as both mixed and high severity (see Section 3.16). Mixed severity fires are not stand-replacing but rather create a patchy mosaic of different mortality (forest structure and diversity) across the landscape – something that is lacking today.

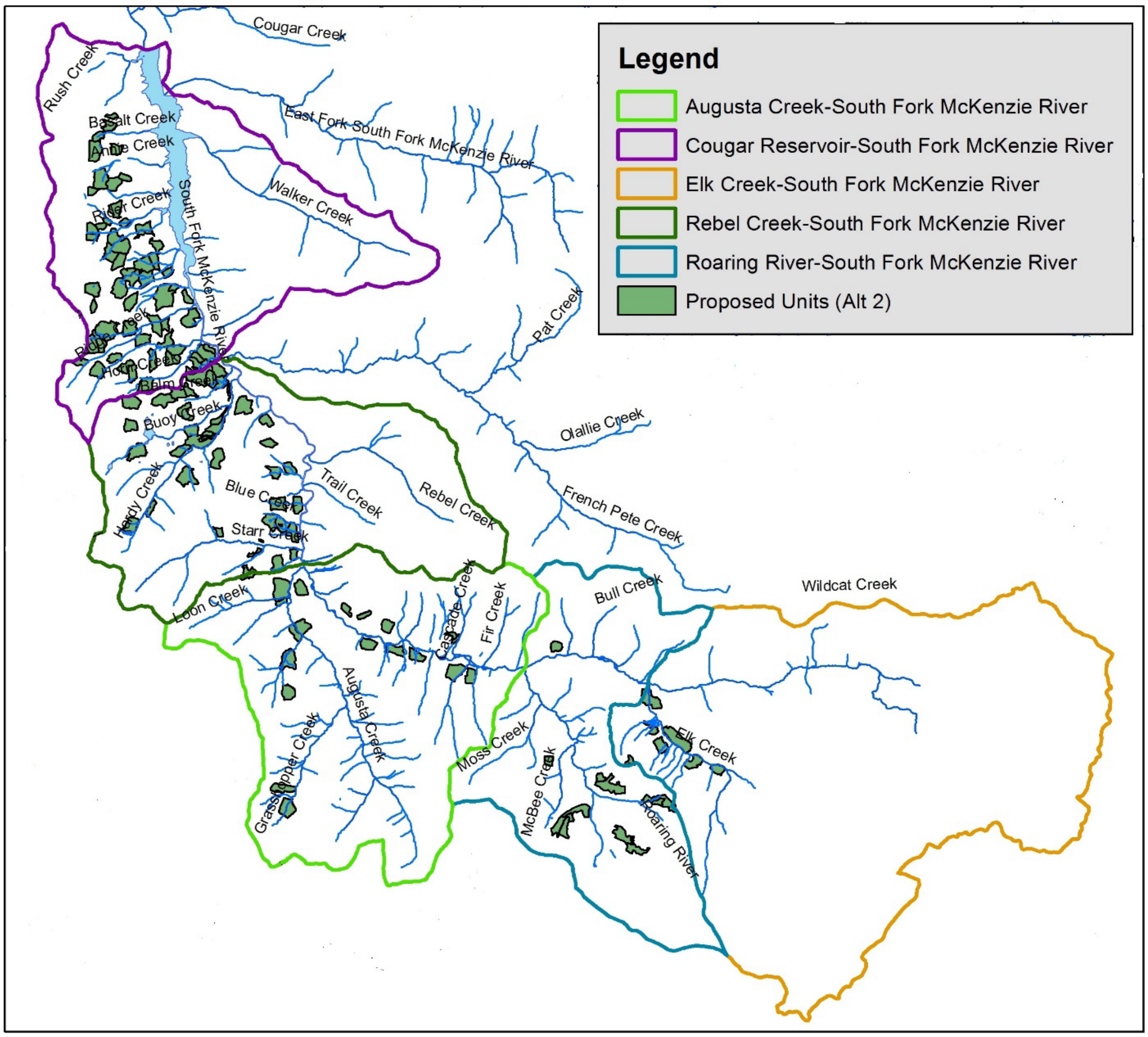


Figure 19. Waterbodies and 6th Field HUC Sub-watersheds within the Green Mountain Project Area

Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest system lands in the 1970s and 80s. Much of this activity that occurred prior to implementation of the

Northwest Forest Plan resulted in removal of riparian vegetation that provided large wood and shade to the small tributary streams in the project area. There are pockets of mature forest, but most of the land has been impacted by management and recreation. Some Riparian Reserves were clear-cut and replanted with Douglas-fir. As a result, many of these stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominant stands, with tree densities above the natural range of variability expected in this area. Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al. 1997; Poage and Tappeiner 2002). Stand densities in the project area range from 79 to 362, with an average of 189. Additionally, Pollock et al. (2005) found that natural "riparian stands often develop in a much more open structure, such that stem exclusion is much less common and understory vegetation usually is present throughout the development of a forest." The existing lack of complexity and diversity of many of the stands in the project area may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian dependent wildlife.

Historic stream cleaning along the South Fork McKenzie River led to the removal of much of the in-stream wood. In order to assess aquatic habitat conditions, the Forest Service conducted stream surveys most recently in 2005 including wood counts which are summarized in Table 27. A goal of 80 "large" pieces per mile has been set by fisheries agencies to characterize habitat as "properly functioning." As indicated by the Table 27, the South Fork McKenzie and its tributaries do not reach this goal even in the streams influenced by wilderness. Projects to add wood to the South Fork McKenzie River channel have been implemented since 1995. Since that time, 841 trees or logs have been placed in the South Fork McKenzie between the Augusta Creek and the Elk Creek confluences. Little is known of wood counts in the smaller unnamed streams within project units since few are fish-bearing and are not typically surveyed using the standard USFS protocol. Field surveys were conducted in all proposed units, but these surveys provided only an estimated size range of "pool forming" wood and an estimated range of abundance.

Fire has been suppressed in the watershed for over 100 years, and historic logging practices have greatly altered vegetation patterns. As a result, there is evidence of a lack of early-seral vegetation within the whole South Fork McKenzie watershed. Within the project area, there is currently less than 4% of early-seral vegetation (<20 years old) in Riparian Reserves. The natural range of variability is between 5 and 20 percent (Swanson 2012); and a large component of this early seral vegetation is deciduous and herbaceous, particularly within riparian areas (Gregory et al. 1991).

Within the project area, mature and late-seral vegetation currently make up about 75% of the watershed (South Fork McKenzie WA 2010). However, most of this is in the mature forest classification and within the Wilderness. For stands older than 180 years, the level is closer to 34%. In late-seral stands, shrubs and herbs are reinitiated as conifers die and create gaps in the canopy. A recent study of riparian plant communities in northwest Oregon (McCain 2004) provides data on "relatively unmanaged" conditions. In this study, a total of 441 sites in the west Cascades were surveyed, with many of the Willamette sites on the McKenzie River Ranger District. The study describes riparian and upland plant communities based on geomorphic features (e.g. in-channel, cobble bars, terraces, floodplain, etc.). On the "steep banks/terraces" and "high terraces/major floodplain" features (common to streams in the project area), deciduous trees had typical percent cover values of 15-64 percent. Additionally, valley cross-sections (300-foot riparian transects) on 3rd and 4th order "relatively unmanaged" streams in the west Cascades had a hardwood basal area of 7-16 square feet/acre and hardwoods were present throughout the 300-foot transect. This study suggests that in "relatively unmanaged" riparian plant communities, there is typically a hardwood, shrub, and herb component. These deciduous and herbaceous species provide many benefits to riparian and aquatic ecosystems, including better food resources and higher productivity for aquatic invertebrates compared to conifer-dominant systems (Sedell and Dahm 1984; Webster and Benfield 1986; Romero et al. 2005; Allen 1995; Wipfli 1997; Wipfli and Gregovich 2002; Cummins 2002; Allan et al.

2003; Musselwhite and Wipfli 2004; Wilzbach et al. 2005; Kiffney and Roni 2007); increased nitrogen fixation, organic matter cycling, and soil fertility (Compton et al. 2003); and wildlife benefits. Figure 20 illustrates the desired conditions for late-seral Riparian Reserves with a mix of species and complex stand characteristics.

Figure 20. Desired Conditions for Late-seral Riparian Reserves

Based on the fact that there is a lack of both early- and late-seral vegetation classes that have a large deciduous and herbaceous component, it follows that these species are underrepresented on the current landscape. This is further supported by analysis of existing vegetation using high resolution satellite imagery. WorldView 2 imagery has eight multispectral bands including the Red-Edge band, which improves the accuracy of remotely sensed plant studies. The analysis is based on the fact that chlorophyll in living plant material strongly absorbs visible light and strongly reflects near-infrared light. Because deciduous vegetation has higher chlorophyll production than conifers, the imagery helps distinguish between coniferous and deciduous vegetation. A commercial computer software program called eCognition is then used to generate polygon boundaries around the different vegetation types distinguished in the WorldView 2 imagery. The polygons were then classified into eight different classes: conifer dominant, deciduous tree (>2 meters tall) dominant, deciduous shrub (<2 meters tall) dominant, mixed conifer and deciduous, large wildfires since 2011, water, snow or glacier, and other (non-forest, bare ground, grass, etc.).

The analysis found that, upstream of Cougar Dam, only 3.0% of the Riparian Reserve area is deciduous and deciduous/shrub. Figures 21 and 22 show the classified vegetation for the South Fork McKenzie Watershed. The analysis of the current coniferous versus hardwood component of the Riparian Reserves shows little difference between wilderness and non-wilderness. However, wildfires have been suppressed within the Wilderness for over 100 years which have also altered their riparian conditions. In addition, late-seral and old growth stands have numerous natural gaps which are frequently colonized by deciduous species (Warren 2013). Since the acres of old growth across the watershed have been reduced over the last century, it can be assumed that so has the deciduous component. Within Riparian Reserves of the

South Fork McKenzie watershed, there is currently less than 5 percent combined deciduous tree and shrubs and mixed deciduous with conifer. The results of this landscape-scale analysis reveal a very low abundance of deciduous species and are corroborated by surveys at the stand scale, where dense conifers dominate Riparian Reserves and there is often a lack of understory development and species diversity. Figure 23 illustrates typical overstocked stands in the project area.

Some portions of Riparian Reserves within the project area have higher structural and species diversity and are providing adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input to waterbodies, and habitat for riparian-dependent wildlife. Figure 24 illustrates properly functioning conditions within Riparian Reserves in the project area.

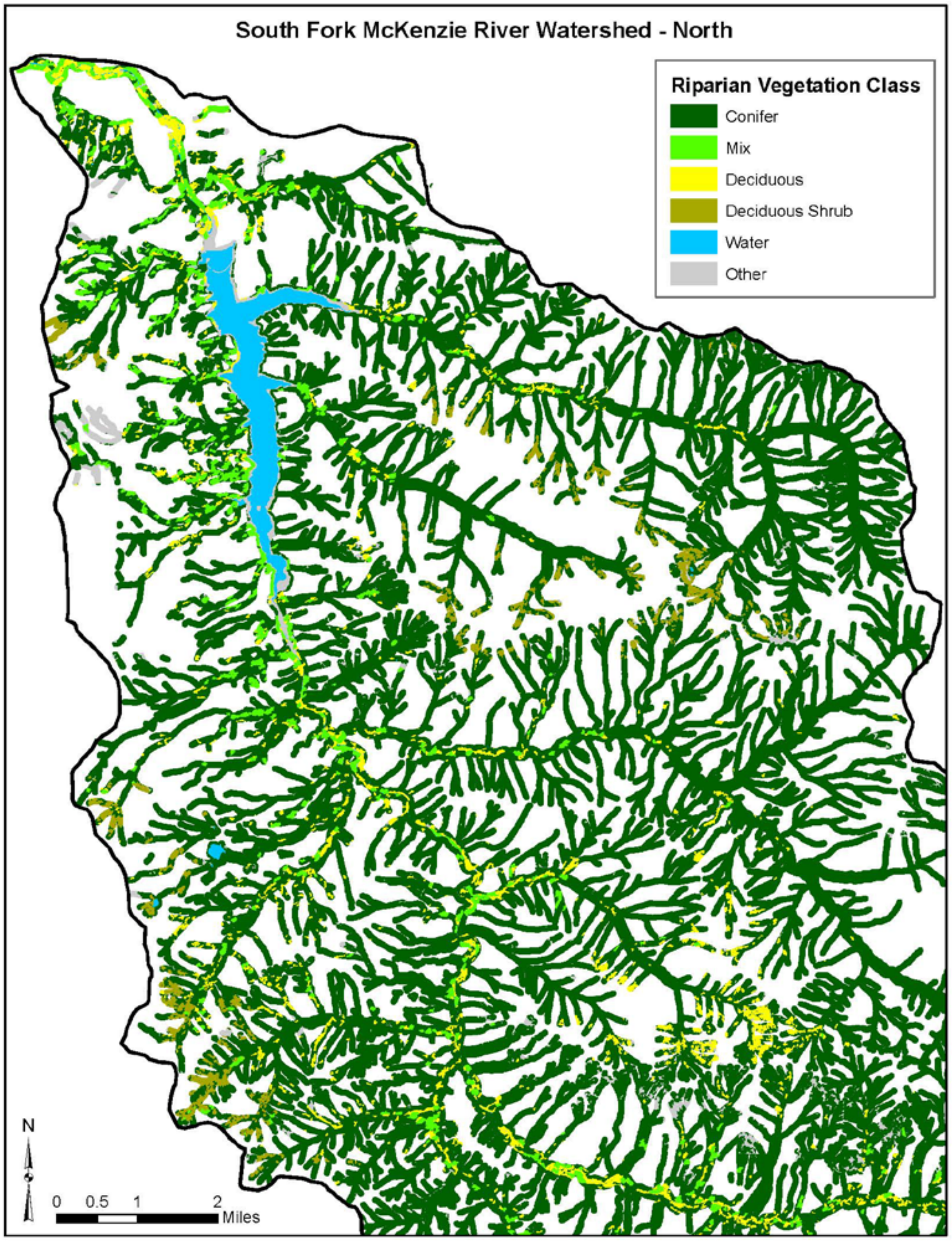


Figure 21. Vegetation Classification of the South Fork McKenzie Watershed (North)

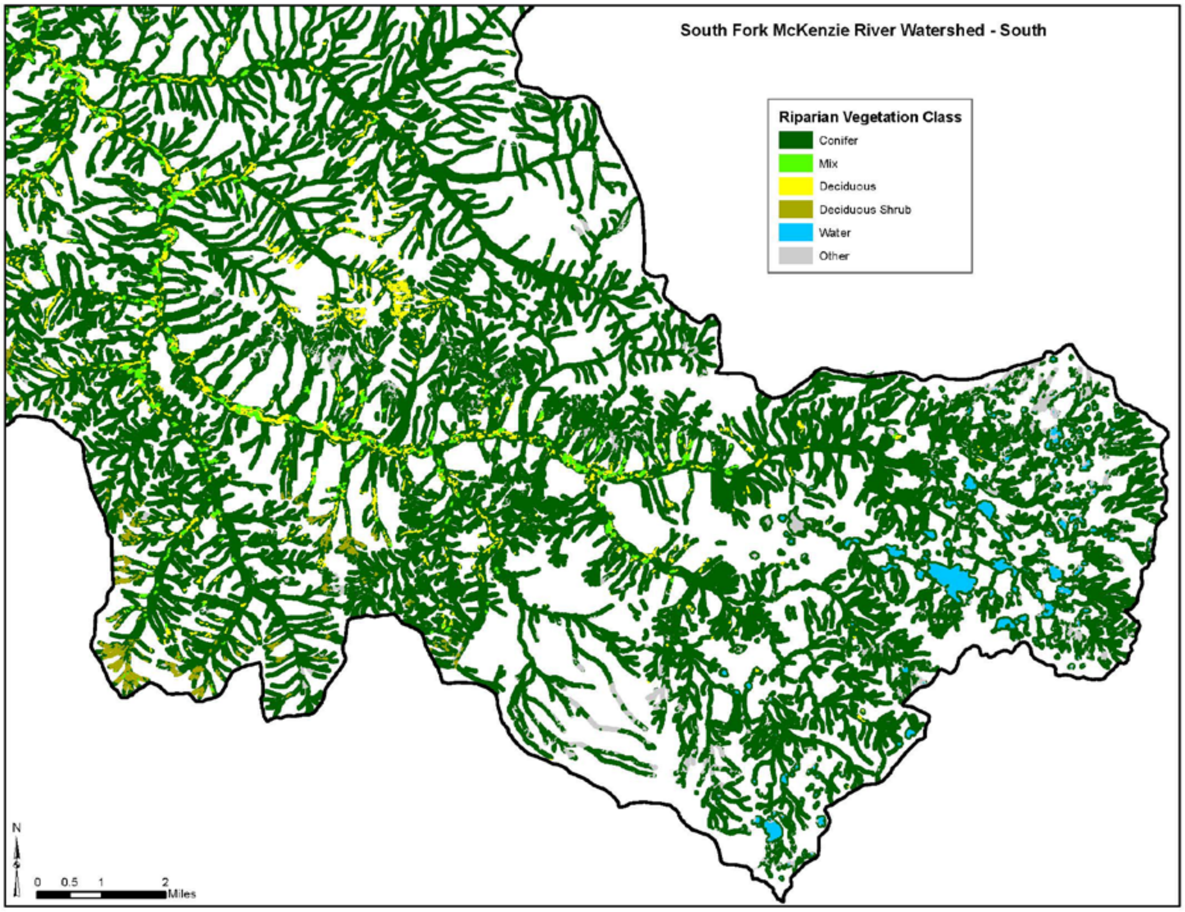


Figure 22. Vegetation Classification of the South Fork McKenzie Watershed (South)

Figure 23. Overstocked, Conifer-Dominant Stand in Riparian Reserves in the Project Area

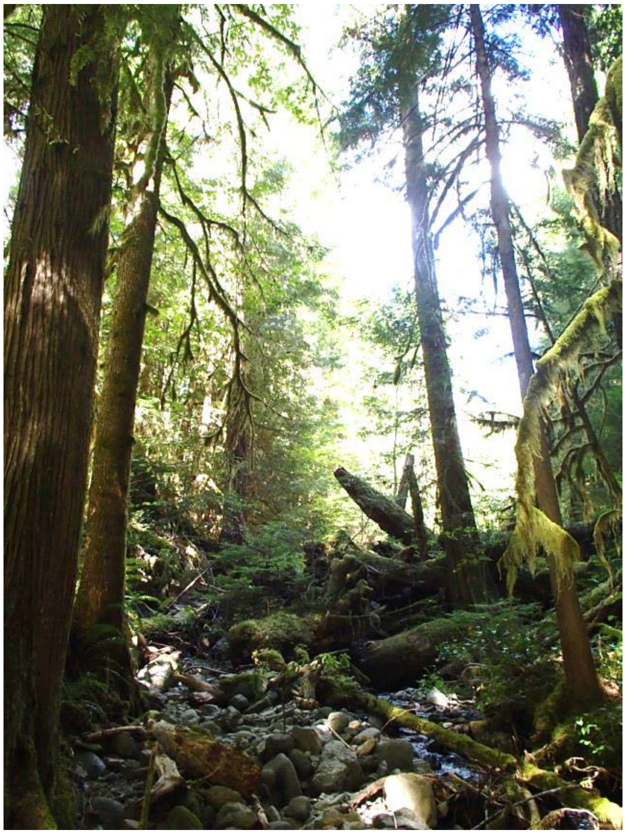


Figure 24. Properly Functioning Riparian Reserves in the Project Area

The overall lack of deciduous and herbaceous vegetation may be impacting stream ecosystems. Nutritional energy becomes available to the stream community from two main sources: photosynthesis by aquatic plants in the stream itself (autochthonous sources) and decomposition of organic matter imported from outside the stream (allochthonous sources). The mix of energy sources has a major influence on the structure and function of stream ecosystems. Streamside vegetation provides large quantities of organic matter in the form of leaves, needles, and woody material. Leaves and needles usually contribute most of the readily usable organic matter in woodland streams (Murphy and Meehan 1991). Leaves and needles need to be conditioned by microbes for about 30 days before invertebrates will consume them.

Conditioning increases concentrations of nutrients in leaf detritus because microbes use nitrate and phosphate from stream water and carbon compounds from the leaf to build their own proteins thereby decreasing the carbon to nitrogen (C:N) ratio of the detritus. Most animals require food with a C:N ratio less than 17:1. Almost all forms of allochthonous organic matter have a C:N ratio higher than 17:1 so they require microbial processing to enhance food quality. The quality of various forms of organic matter varies widely as measured by the C:N ratio or the percentage of lignin. At the low quality end of the spectrum are woody debris and conifer needles and at the high quality end are periphyton, macrophytes, and fast-decaying deciduous leaves (Murphy and Meehan 1991).

In summary, the riparian vegetation and large woody material that provide for aquatic and terrestrial habitat complexity have been altered throughout much of the watershed and project area due to: clearcutting and replanting to single species monocultures; removal of hardwoods from riparian areas; removal of in-stream wood; replanting to create overstocked conditions; and removal of fire disturbance mechanism. Based on data gathered through landscape and stream reach assessments, it was determined that current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics needed to attain ACS Objectives. See Appendix G (Riparian Reserve treatment tables) for more details. Though the trend is slow, the overall aquatic habitat is improving in the project area as the riparian vegetation recovers towards more natural conditions.

3.3.4 Environmental Consequences – Riparian Conditions

Direct and Indirect Effects

Alternative 1 – No Action

Current rates of large wood recruitment, provided mostly by stem mortality (from competition, disease, wind and snow downed trees) and bank erosion, would be maintained. Alternative 1 would provide a slightly higher rate of in-stream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90 percent of the wood recruitment zones, the No-Action alternative would protect 100 percent. In some streams, recruitment trees are of sufficient size to meet ACS Objectives; but in other streams with small diameter riparian stands, the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Small diameter trees are also more likely to be transported out of the system. In-stream wood abundance is low for most streams in the project area and is largely due to the lack of current wood inputs and the lack of stable wood in channels.

The No-Action alternative would not accelerate desired vegetation conditions. Desired riparian conditions – high species and structural diversity with large dead and down wood – would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively lower levels. Accelerated restoration of riparian stands that currently do not meet ACS Objectives would not be accomplished. Alternative 1 would perpetuate the impacts of homogenous, densely stocked stand conditions longer into the future potentially by several decades.

In addition, the currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands. Although these are natural disturbance processes that contribute to forest habitat and diversity, a large disturbance event, or one of high severity, has the potential to reduce vegetation, large woody material, and stream shade across large areas of Riparian Reserves. Research conducted in the Pacific Northwest has shown that while fire severity may be lower along perennial streams due to relatively cool and moist conditions, fire severity along intermittent streams can be similar to adjacent upland areas (Tollefson 2004). In fact, under some circumstances, riparian areas can become corridors of increased fire spread (Pettit 2007).

Alternatives 2 and 3

The Northwest Forest Plan (NWFP) prohibits timber harvest in Riparian Reserves except as needed to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS Objectives (NWFP Standards and Guides, TM-1(c)). Based on data gathered through landscape and stream reach assessments, it was determined that current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics needed to attain ACS Objectives. Therefore, there is a need to treat parts of the Riparian

Reserves to accelerate attainment of desired conditions. Other areas, however, are currently meeting desired vegetation characteristics and treatment is not necessary. In some cases, maintaining and/or restoring each one of the ACS Objectives can be a balancing act with trade-offs. For example, to meet the riparian vegetation objectives (“species composition and structural diversity of plant communities” and “habitat to support well distributed populations of native plant, invertebrate and vertebrate riparian dependent species”) in young, dense conifer stands, a common silvicultural tool is to remove overstory density to encourage understory growth and structural development. Removal of overstory density, however, could potentially lead to increased thermal loading or reduction of wood volume available for recruitment. Because of these trade-offs, conflicting objectives were carefully balanced based on characteristics of each waterbody and adjacent riparian area.

Alternatives 2 and 3 propose both active and passive management of Riparian Reserves: thinning, gap creation, down wood augmentation, and no treatment. Below are descriptions of the types of treatments proposed and the considerations for analysis with each.

Thinning in Riparian Reserves

The body of literature on the effects of thinning on stream and forest ecosystems is quite extensive. Several key factors in determining where this type of treatment would be beneficial for the attainment of ACS objectives were considered. In-stream wood recruitment, upland down woody material levels, stand structure, and species composition are described below. Stream temperature, sediment, riparian microclimate, and other factors are described in the sections below. Alternative 2 would thin approximately 902 acres and Alternative 3 would thin approximately 894 acres within Riparian Reserves. Appendix G details where treatments are proposed within Riparian Reserves and the vegetation objectives for each unit in Alternative 2 and 3.

<u>In-Stream Wood</u>

In-stream wood in important to the health of aquatic habitats, and many researchers have studied the areas along streams where wood recruitment typically occurs. Wood recruitment zones, as they are called, vary from as little as 8m (26 feet) up to about 45m (148 feet) depending on various factors (Benda and Bigelow 2014, Spies et al. 2013). According to Benda and Bigelow (2014), wood source areas are highly variable, but are strongly correlated to tree height and the dominant wood recruitment process for each stream reach. In their study, they found that in managed forests of the Cascades Range, where bank erosion and tree mortality are the dominant wood recruitment processes, 90 percent of in-stream wood originated from within about 8 meters (26 feet) of stream channels and the remaining 10 percent is supplied from a distance equivalent to one tree height. Figure 25 shows the source distance curves for wood in Benda and Bigelow (2014). In less managed and unmanaged forests, 90 percent of in-stream wood originated from about 13 meters (43 feet) of stream channels.

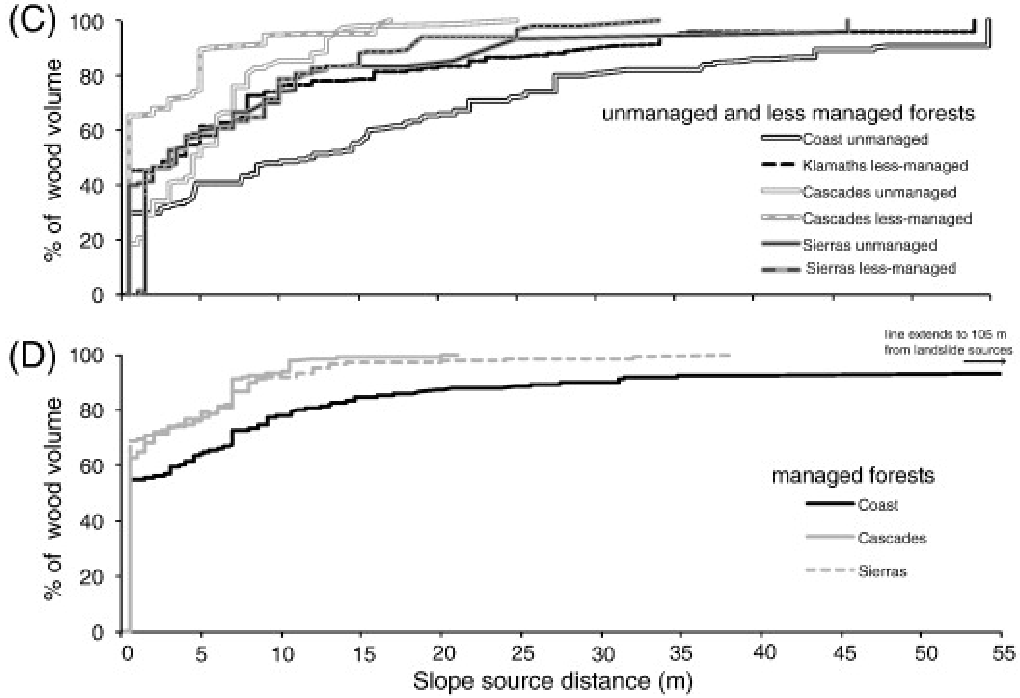


Figure 25. Source Distance Curves for Study Area (Brenda and Bigelow 2014)

In Meleason et al. (2003), the simulation model OSU STREAMWOOD was used to evaluate the potential effects of different riparian thinning scenarios on wood recruitment to streams over time. In one scenario, they modeled the contribution of wood from forest plantations (up to 120 years old in a Douglas-fir – western hemlock forest), beyond no-harvest buffers of varying widths. The results suggest that no-harvest buffers greater than 10 meters (33 feet) from the stream channel contributed minimal amounts of wood volume to streams. In McDade et al. (1990), the mean wood source distance for first, second, and third order Cascade and Coast Range streams in mature and old growth stands was approximately 10 meters. Conifer tree heights in these stands ranged from 40 to 80 meters (131 to 262 feet). Johnson et al. (2011) demonstrates that in streams adjacent to undisturbed mature or old-growth forests in central and southern British Columbia, 90 percent of the wood at 90 percent of the study sites originated within 18 m (59 feet) of the channel. Robison and Beschta (1990) determined that the probability of a tree falling into a stream channel is primarily a function of tree height and distance from the stream. The upper crown of a tree, however, particularly in managed stands, is not of sufficient size to be considered of functioning size in the channel (i.e. large enough to influence stream morphology). Therefore, the “effective tree height” – the height to the minimum diameter and length necessary for the wood to qualify as “of functioning size” – is a more appropriate standard to use for assessing source area distance.

In all of the proposed riparian thinning stands, an area near the stream was designated as a no-harvest buffer to protect these wood recruitment zones as well as other resources such as temperature. The overall goal for developing wood recruitment zones was to protect at least 90 percent of trees that could potentially be recruited to the stream channel. This level of future wood input is thought to be sufficient levels to sustain physical complexity and stability required by the ACS Objectives. This no-harvest buffer ranges in width depending on specific conditions in each unit (i.e. width and gradient of stream, vegetation characteristics, etc.) and by stream type (i.e. seasonally flowing streams, perennial non-fish bearing streams, and fish bearing streams). Based on the research findings, a primary wood recruitment zone of 30 feet from each side of narrow (typically the intermittent class 4 and small class 3) stream channels was defined for young, dense stands within the project area, where bank erosion and tree mortality are the dominant wood recruitment processes and average tree heights range from 57 to 95 feet. Along the wider perennial and fish bearing streams where average tree heights were greater than 95 feet, no-treatment buffers range from 60 feet to 360 feet depending on conditions.

Terrestrial Down Wood
In addition to in-stream wood, numerous studies have been conducted that address both the specific roles of down wood in ecosystem as well as its ecological function for wildlife and aquatic species. However, it is less easy to quantify the exact levels of down wood expected to have occur in the upland portions of Riparian Reserves assuming there were no human impact to the forest since these are subject to many variants. Only two management rotations in Douglas-fir stands have been estimated to reduce the abundance of dead wood by 90% compared to levels in natural old-growth systems (Rose et. al.). It should be noted that stands go through a “U” shaped pattern of down wood development naturally; and depending on stand age, a fluctuation of LWM is expected.

An estimate of the range of natural variability was used to develop down wood objectives. These objectives were based on input from wildlife specialists, modeling exercises using Forest Vegetation Simulator (FVS), and scientific literature review. Across the project area, current levels of down wood are within estimated historical ranges (see Section 3.5 for more information). Field surveys of the Green Mountain proposed units during 2011 and 2012 showed approximately 38% of all proposed units to have higher levels of large down logs (over 14” diameter) over 6/acre, 58% had moderate levels of about 3-6/acre, and about 4% had low levels of large down logs under 3/acre. Many of the plantations showed relatively high levels of large down wood that was left from the original harvest, with quite large diameters over 40”, such that it will last many more decades.

The number of total trees per acre (i.e. this number includes trees less than 7 inches in diameter) within most of the Riparian Reserve treatment areas range from 176 to 1,822. Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al 1997; Poage and Tappeiner 2002). Given the unnaturally over-stocked conditions of these managed stands, in the long term (decades to a century) there will still be adequate woody material to maintained volumes within the natural range of variability, and abundant overstory would be retained for future wood input sufficient to sustain the objectives listed in the Aquatic Conservation Strategy (Appendix E).

However within specific treatment units where current estimates are below the desired ranges, dead and down wood objectives would be met through leaving more of the residual stand or through supplemental down wood creation treatments. These treatments are proposed as a potential enhancement effort so that habitat needs could be met at a site specific as well as a landscape level.

Stand Structure and Species Composition
Based on a review of existing literature and stand development theory, Spies et al. (2013) found that the “greatest potential ecological benefits of thinning to accelerate the development of older forest structure (e.g. large trees, large dead trees, spatial structure and compositional heterogeneity, etc.) come in dense uniform plantations less than 80 years and especially less than 50 years old.” The benefits of thinning in stands over 80 years old are more variable. Stand conditions were reviewed for each waterbody and recommendations were based on multiple variables, not just age. These factors included tree height and diameter, stand density, species composition, and understory development.

In Alternative 2, most stands where thinning would occur within Riparian Reserves are under 80 years old however. Thinning in stands over 80 that contain Riparian would occur in only two units in Alternative 2 (Units 1890 and 5800). However, based on field review of these units by resource specialists, no treatments within the Riparian Reserves were recommended.

No stands over 80 are proposed for treatment in Alternative 3. This would only eliminate approximately eight acres of riparian treatment. The effects of not treating the eight additional acres would be localized and not perceptible at the landscape scale.

Where thinning is proposed within Riparian Reserves, increases in abundance of understory vegetation, species diversity, stand structural diversity, and tree growth at a faster rate than background levels are expected. It should be noted that some modeling has shown that young conifer stands, if left untreated, would follow a trajectory towards forest structure found in certain reference conditions (Pollock et al. 2012). Reference conditions were considered to have mature, late-successional conifer dominated stands with abundant large trees in the overstory, abundant large snags, and a well-developed understory of shade-tolerant trees. However, according to Harrington et al. (2005) thinning tends to increase shrub cover and greatly increase within-stand variability where shrub cover is absent before treatment. Riparian thinning can also promote the development of late successional forest attributes of value to many riparian and upland-associated species (Pabst et al. 2008, Harrington et al. 2005). Based on new research (Ruzicka et al. 2014), increased tree growth within no-treatment buffers adjacent to thinned stands is also anticipated. In their study, trees responded to an apparent edge effect up to 15 m (49 feet) downslope of thinned areas. So it is expected to have similar beneficial effects within a large portion of the no-treatment buffers.

In order to add additional structural complexity, vegetative diversity, and habitat diversity some of the Riparian Reserve stands proposed for thinning also have small gap creation of a total of 4 acres (<0.25 acres each gap) in the secondary shade zone to enhance terrestrial habitats which are also a component of the ACS objectives (see Wildlife Section and Appendix E). Table 16 shows a list of these proposed units.

Table 16. Proposed Units with Wildlife Gaps in the Secondary Shade Zone

Stream Name/Class	Unit	Treatment Description
Penny Creek, Class 3	740	Fall and leave conifers to create gaps <0.25 acres each in the secondary shade zone for a total of approximately four acres.
Class 2 and Class 4	820	
Class 4	1110	
Class 4	1200	
Class 4	5370	
Class 2	5380	

A minimum of 50 percent canopy closure (approximately 40 percent canopy cover) would be maintained throughout the stand (which results in an average of 70-90 trees per acre remaining on site which is slightly higher than average old growth stand densities. Over all, the proposed prescriptions are a compromise between thinning and retention to try and meet the greatest diversity and important resource protection needs such as microclimate and future large wood input.

No-Harvest Treatments in Riparian Reserves

Alternative 2 and 3 propose a variety of management actions for Riparian Reserves. One action is to leave the current stand relatively intact. The no-harvest portions of the Riparian Reserves were selected where added protection of existing habitats were needed. These no-harvest areas are either partial buffers within the Reserves or full Riparian Reserves. For example, units 1890 and 5800 are mature stands over 125 years while units 5430 and 5420 are younger (<80 years old). However, the Riparian Reserves in all of these units and several others show existing stand and vegetation diversity, sensitive habitat, soil stability issues, temperature sensitivity, or existing quality aquatic habitat so no thinning was recommended within the Riparian Reserves. Information on proposed silvicultural treatments in Riparian Reserves, or non-treatment, can be found in Appendix G.

Fall-and-leave In-stream Treatments in Riparian Reserves

Several streams were identified during field surveys to have a shortage of large woody material within the channel or floodplain. Selected streams were chosen for their vegetation characteristics at the stream catchment scale and at the site-specific scale. The large majority of riparian stands along the entire length of the following streams are dense plantations lacking structural and species diversity. Units 5030, 5080, 5230, 5420, 5440, 5460, and 5470 have stream side fall-and-leave prescriptions along approximately 2.7 miles of fish-bearing streams (Table 17). This would be done either through fall-and-leave individual or small groups of trees or through whole tree winching to leave the rootwads attached.

Table 17. Proposed Units with In-stream Fall-and-Leave Treatments

Stream Name/Class	Unit	Treatment Description
Pass Creek, Class 2	5080	Fall conifers into channel every 50-100 feet alternating sides and avoid bank trees
	5230	
Elk Creek, Class 1	5420	Fall conifers into channel every 50-100 feet alternating and avoiding bank trees. Every 200-400 feet, fall 5-10 trees into the channel as a clump.
	5440	
	5460	
	5470	

Near-stream Gap Treatments in Riparian Reserves

Approximately 3.5 acres of near-stream gaps are proposed within 6 units (Table 18). There are several objectives for these treatments including increased light availability for primary productivity and increased deciduous vegetation for allochthonous material (decomposition of organic matter imported from outside the stream). Historic logging and dense conifer revegetation in the project area has resulted in a lack of deciduous vegetation along many streams. These homogenous conifer stands near streams have been shown to impact the food supply and thus the lifecycle of macro-invertebrates (Hoover 2011). Also, mature and old-growth stands exhibit a mixture of heterotrophic (shaded) and autotrophic (lighted) habitats within stream reaches (Stovall 2009, Warren 2013).

Research and field surveys indicate that near-stream gaps may be appropriate in certain situations:

- Drainages with dense conifer canopy (i.e. plantations) where stream productivity may be relatively low
- Lower gradient reaches (<10 percent) that have higher potential to retain and process organic inputs
- Streams tightly coupled to biological hotspots (e.g. South Fork McKenzie River, tributary junctions) where increases in productivity could be utilized
- streams with low sensitivity to thermal loading and erosion
- riparian areas within plant associations that should have a hardwood/deciduous component

This treatment would increase light availability to streams by 20-30 percent to increase primary productivity and increase the hardwood component in order to begin to emulate old-growth characteristics. Canopy gaps have been shown to play a major role in providing light to streams within old growth stands and is significantly higher in those reaches than within younger (approximately60 years old) closed canopy stands (Warren 2013). Some removal of trees out of the gaps may be required in order to allow regeneration of early serial species. However, these trees would be left in the Riparian Reserves for large woody material. Monitoring will be a major component of this project. All of the proposed near-stream gaps are within young plantations <80 years old. Maps of these proposed units can be found in Appendix G.

Table 18. Units with Proposed Near-stream (primary shade zone) Gap Treatments

Stream Name/Class	Unit(s)	Treatment Description
Class 3 (2 streams)	420, 430, 440	fall and leave conifers to create < 0.25 acre gaps to promote hardwood and understory growth
Class 3	500	fall and leave conifers to create < 0.25 acre gaps to promote hardwood and understory growth
Class 3	530, 600	fall and leave conifers to create < 0.25 acre gaps to promote hardwood and understory growth

Other Treatments

Within some treatment units, the introduction of low severity fire into patches of Riparian Reserves is anticipated during hazardous fuels treatments. Fire would be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fire line around the Reserves which would potentially result in erosion. With local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, would be retained. In lightly burned areas, understory conifers would experience some mortality, but fire adapted species such as willow and other hardwood shrubs would re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. At low burn severities, large wood would not be removed from the Reserves. The net results, though localized, would be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than non-thinned plantations.

Table 19 summarizes the acres of Riparian Reserves affected by the various vegetation treatments. It also includes the number of acres that would not be treated based on recommendations from site specific field visits.

Table 19. Riparian Reserve Management on Federally Managed Lands in the Project Area

Total Riparian Reserves within the Project Area	Activity	Proposed for Treatment		
		Alternative 1	Alternative 2	Alternative 3
64,300 acres	Thinning	0 acres	902 acres	894 acres
	No Treatment	0 acres	762 acres	749 acres
	¼ acre Gaps (near-stream)	0 acres	3.5 acres	3.5 acres
	¼ acre Gaps (secondary shade zone)	0 acres	4 acres	4 acres
	Fall and Leave	0 acres	2.7 miles	2.7 miles

Wherever possible, temporary roads would be located on ridge tops, gentle slopes, or would utilize locations previously disturbed by historic logging that had not been decommissioned. Those segments located within the Riparian Reserves would be located well outside of the primary shade zone or cross perpendicular to the stream. Alternative 2 will have about 2.3 miles of temporary roads within the Riparian Reserves. This is equivalent to approximately 11 acres of disturbance. Alternative 3 will have a similar length of temporary roads (about 2.1 miles) in Riparian Reserves. There are 14 proposed temporary stream crossings which are needed to access portions of units. Impacts to large wood are expected to be similar to those of thinning treatments. Typical rates of re-vegetation start occurring within 2 decades from natural regeneration if the disturbed area is not replanting. All temporary road crossings would be removed, and all temporary roads in Riparian Reserves would be decommissioned after treatment activities are completed.

In summary, Alternative 2 would thin approximately 902 acres within Riparian Reserves. Additionally, 3.5 acres of gaps would be created within the secondary shade zone and 3.5 acres of near-stream (primary shade zone) gaps. Approximately 2.7 miles of stream would have large wood enhancement treatments. Alternative 3 would thin approximately 894 acres within Riparian Reserves, and all other treatments would be the same as Alternative 2. The adverse impacts of thinning on in-stream large wood and future recruitment would be very minor at the watershed, project, and reach scales because only 902 and 894 acres (less than 1.5 percent) of Riparian Reserves would be thinned in Alternatives 2 and 3, respectively, and within those units at least 90 percent of the wood recruitment zones would be protected. The minor reduction in wood recruitment would occur at a very slow rate due to the naturally slow rate of the dominant wood recruitment processes (bank erosion and tree mortality) of streams in the project area. The beneficial impacts of thinning to accelerate tree growth would also be very minor at all scales due to the relatively small area treated and slow rates of tree growth. The beneficial impacts of thinning on riparian forest structure and diversity would be minor at the watershed scale due to the limited area of treatment (<1 percent), but would have measureable beneficial impacts at the project and unit scales. Benefits of thinning are well documented, would start occurring within 3-5 years, and would persist for decades. Analysis and field reconnaissance of Riparian Reserves by fisheries, hydrology and wildlife personnel on a unit by unit basis assured that Riparian Reserve prescriptions will provide for small wood inputs from no-harvest buffers and fall and leave in the short term (1-2 decades) while treating outer portions of riparian reserves for long-term (2-5 decades or more) shade, wood source and terrestrial habitat complexity. Table 19 summarizes the acres of Riparian Reserves affected by the various treatments. The proposed management of Riparian Reserves in Alternative 2 and 3 would not deter attainment of and would largely benefit ACS Objectives. The Aquatic Conservation Strategy compliance document (Appendix E) explains how each Objective is maintained or improved. Refer to Appendix G for overview maps of the Riparian Reserves within the project area and locations of the various riparian treatments.

Cumulative Effects

Alternatives 2 and 3

Federal timber sales and pre-commercial thinning are ongoing in the project area, and the cumulative effects are a reduction in Riparian stand densities and a short term (1-2 decades) reduction in small woody material. All recent and planned timber harvest, riparian habitat complexity development, and road decommissioning projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix F) were analyzed for effects to riparian condition and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the minor impacts expected from the Green Mountain project would not measurably contribute to impaired riparian conditions.

Private timber lands are present in the project area. Although they are managed according to Oregon Forest Practice Rules, impacts to streams may occur. Because the primary shade and wood recruitment zones would be protected and impacts minimized on federal lands, cumulative effects to streams across the watershed are not anticipated.

3.3.5 Affected Environment – Stream Shade and Temperature

Major road construction and timber harvest began in the Green Mountain project area in the 1940s, peaking in the 1970s and 80s. Much of the activities that occurred prior to implementation of the Northwest Forest Plan resulted in removal of riparian vegetation that provided shade for streams.

Stream temperature data were collected at 19 locations in the project area during the summer months (June through September). The data were collected for a minimum of two seasons with a maximum of 10 seasons. A summary of the data for South Fork watershed is provided below in Table 20. Control streams were selected because they are relatively un-impacted and were thought to be hydrologically/geologically similar to the project area streams. In addition to capturing the summer temperatures, NetMap was used to model the potential thermal sensitivity to various stream reaches.

The existing conditions for temperature in the Green Mountain project area varies widely even between the control streams. Much of this variability is due to the geology underlying the stream channels. Both the South Fork McKenzie near the Wilderness boundary and Elk Creek flow from the groundwater dominated High Cascades geology and exhibit the characteristically colder temperatures. Walker and French Pete flow from ridge capping basalts in the characteristically warmer West Cascades geology. Rebel is on the boundary between the West and High Cascades and exhibits intermediate temperatures.

Like the streams that run through project units, Roaring River and the upper reaches of the South Fork flow through managed stands but exhibit cooler temperatures due to the High Cascades geological influence. Augusta Creek is the warmest of the streams within the project area despite having the highest percentage of older stands. The upper reaches of the stream are buffered by older plantations and mature stands while the lower mile and a half flows through younger plantations. This vegetation pattern may partially explain the warming trend of the stream. Other factors that influence the stream's temperature are the predominant south/north direction of the channel which also increases solar radiation potential and the historic removal of in-stream wood. Grasshopper Creek is similar to upper Augusta in geology, drainage size, orientation, and vegetation composition; and thus the temperatures are also similar. Upper Starr Creek is influenced by coarse heterogeneous glacial deposits where hyporheic flow (water flowing in and out of the gravel beds and banks) can cool the stream. Hardy Creek is the second warmest stream that flows through the proposed units. It lies along the edge of a deep seated earthflow which typically has a cooling effect on the temperatures due to groundwater contributions. However, it too flows in a predominately south/north direction with higher solar radiation potential in most of the lower reaches, and several of its larger tributaries have experienced debris flows that have removed vegetation and gravel. Ridge Creek lies almost entirely in old earth flow terrain with low to moderate solar radiation potential.

Changes in the range of maximum temperatures from one water year to the next are attributable to annual differences in precipitation and stream flows. The annual timing of the maximum temperature occurred between July and August in all instances.

Table 20. Stream Temperatures for the Green Mountain Project Area

	Lowest Max. Daily Temp. °C*	Highest Max. Daily Temp. °C*	Range of Values °C	Composite Average Value °C
Control Streams				
Elk Creek	8.8	9.7	0.9	9.1
Walker Creek	12.9	16.3	3.4	14.5
Rebel Creek	12.2	14.1	1.9	13.2
French Pete Creek	14.5	17.1	2.6	16.0
S. F. McKenzie (Wilderness boundary)	8.6	10.7	2.1	9.7
Non-Control Streams				
Roaring River	7.3	7.5	0.2	7.4
S. F. McKenzie R. (upper)	9.5	9.9	0.4	9.6
S. F. McKenzie R. (middle)	11.1	11.4	0.3	11.3
S. F. McKenzie R. (lower)	12.8	13.8	1.0	13.3
Grasshopper Creek	12.9	14.3	1.4	13.5
Starr Creek (upper)	11.9	13.1	1.2	14.5
Starr Creek (lower)	14.4	16.3	1.9	15.2
Augusta Creek (upper)	12.4	14.6	2.2	13.2
Augusta Creek (lower)	16.2	19.0	2.8	17.8
Hardy Creek (upper)	10.7	11.3	0.6	11.0
Hardy Creek (lower)	13.7	16.2	2.5	15.5
Ridge Creek	13.8	15.2	1.4	14.9

* Maximum 7-day average

Under section 303(d) of the 1972 Clean Water Act, states are required to develop lists of impaired waters. Lower reaches (river mile 0-4.5) of the South Fork McKenzie had been listed as 303(d) for temperature (12.8° C) prior to the 2010 revision. Data above the Reservoir were insufficient to list in the 2010 revisions. From the data collected internally by the Forest Service, most of the South Fork McKenzie is at or below the 12.8° C criteria for spawning. Augusta is listed as a potential concern (criteria 17.8° C). Both French Pete and Rebel are Category 2 with specific water quality standards being met or trending that direction. However, French Pete which is almost entirely in the Three Sisters Wilderness is close to the 16° C criteria for cold water habitat. (Oregon DEQ. 2004/2006 and 2010. 303(d) List of Impaired Waters). The high temperatures with French Pete goes to show the significant role that the underlying geology can have on stream temperatures.

3.3.6 Environmental Consequences – Stream Shade and Temperature

Direct and Indirect Effects

Alternative 1 – No Action

Activities that affect shade vegetation would not occur. Water temperatures in streams in the project area would continue to recover toward more natural levels as riparian vegetation that was disturbed or removed by management activities prior to implementation of the Northwest Forest Plan re-grows and re-establishes streamside shade. However, with the increased risk of high severity wildfire, which is carried more easily through dense stands, this may affect water quality in the future. The corresponding loss of vegetation and duff may affect temperatures and microclimates around the edges of the streams and wetlands. Intermittent (class 4) streams and seasonal wet meadows go dry during the summer when temperatures are typically an issue. So increased stream temperature at the current vegetation conditions or after a high-severity fire is not expected in most of the class 4 streams in the project area. However, temperatures in perennial streams would be effected as would microclimates. See the Fire and Fuels Section in Chapter 3 for more specifics on the probability and effects of wildfires in the project area.

Alternatives 2 and 3

The system of Riparian Reserves under the ACS provides zones around streams, wetlands, and water bodies that contribute to protecting or restoring the physical, chemical, and biological integrity of these waters, which is the major goal of the Clean Water Act. For all action alternatives, treatments within riparian areas have been designed to comply with the "Northwest Forest Plan Temperature TMDL Implementation Strategies – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (TMDL 2012). All streams except Roaring River exhibit intra-annual variability greater than 0.3° C despite the fact that there has been no additional vegetation management along these streams during the time they were monitored.

To comply with the stream temperature standards, no-harvest buffers were developed to eliminate management effects. These buffers were developed based in part by calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading, known as the primary shade zone; and the width of the riparian area that provides shade in the morning and afternoon, considered the secondary shade zone. Research has shown that in many cases significant changes in stream temperature are not observed with partial no-harvest buffers within the Riparian Reserve width (Levno and Rothacher 1967, Brown and Krygier 1970, Swift and Messer 1971, Macdonald et al. 2003). In several cases, buffer distances less than one site potential tree have been shown to protect water temperature. Typically the primary shade zone is half of the site potential tree height. Gomi et al. (2006) reported maximum daily temperatures in headwater streams did not increase significantly when 30- and 90-foot buffers were applied.

In overly dense riparian stands, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to no shade since trees in the primary shade zone are already blocking the sun's solar radiation. In all of the units with proposed thinning in the Riparian Reserves, conifer densities are high and would benefit from thinning. Where Riparian Reserves are actively managed, a minimum of 50% canopy closure (approximately 40% canopy cover) is preserved in the outer portions (outside the no-harvest buffer) to help protect microclimate also. Some of the streams in the project area are less than 3 feet wide and others have very course substrate. The effective shade is typically less for these streams. In addition, several papers have been published recently indicating that hyporheic flow (water flowing through gravel), not just shade, has a significant influence on stream temperature. Janishch et al. (2012) found that that the canopy cover of "buffers" was not a strong variable for temperature in small (<7feet wide) headwater streams. Instead, the streams with coarse-textured streambeds tended to be thermally unresponsive as compared with fine-textured streambeds or those with small, near-stream wetland areas. This re-emphasizes the important role gravel and large wood play in stream temperatures and was used to further establish no-harvest buffer recommendations.

The development of no-harvest buffer widths also took into account the stream classification. Intermittent (Class 4) streams are dry during the portion of the year when elevated temperatures occur and therefore temperature is not as significant an issue. However, bank stability trees and no-harvest buffers of 30 feet which were designed for other resource objectives would provide substantial shade when water is present regardless. Much of the stream-influenced microclimate would also be preserved since the gradients are strongest within the first 20-30 feet (Anderson 2007) and a portion of the canopy cover throughout the rest of the Riparian Reserve would be maintained. No-treatment buffers on perennial streams have varying widths developed, in part, to accelerate species and structural diversity while protecting effective shade.

Most of the class 3 (non-fish bearing perennial) streams within the proposed harvest units have a minimum 60-foot no-harvest buffer to retain effective stream shade and terrestrial microclimates (Anderson 2007) while still providing the opportunity to thin the rest of the Riparian Reserve for other desired characteristics. Where thermal loading, soil stability, desired stand characteristics, etc. is present; no-treatment buffers are wider. Several class 3 streams have narrower no-treatment buffers in order to accomplish other aquatic and terrestrial habitat goals. The locations selected for these additional thinning treatments are in locations where thermal loading potential is low and where microclimate has less influence on the small streams.

The majority of perennial streams class 1 and 2 (fish bearing) are provided with a minimum of a 60 foot no-treatment buffer to retain effective stream shade. Certain units have additional riparian treatments within the traditional no-harvest buffer for in-stream large wood creation or to increase primary productivity. Approximately 2.7 miles of streams would have wood added. Selection and spacing of trees for large wood creation would be chosen so that they minimized the impacts of canopy removal to stream temperature.

Near-stream gaps are proposed in several class 3 streams with low thermal loading and where there is sufficient vegetation and bed roughness retained above and below the gap to provide shade and to cool the stream. Average width for the small class 3 streams with proposed gaps is about 6-9 feet and average depth is ≤ 1ft. The current canopy cover for the proposed gap units is 74-93 percent. Ridge Creek is about 14.9 °C with about 85 percent canopy cover at that location. Cold water criterion is 16°C. NetMap was used to model thermal warming potential. This model helps provide a large-scale comparison of streams across the watershed, but it has limitations. Most significant of these limitations is that the topography and stream channel gradient are estimated at a constant grade which may minimize the effects of topographic shading and result in slightly higher estimated temperatures. Despite this limitation, the model provides a helpful estimation. Using this model, the reaches where near-stream gaps are proposed have an estimated level of solar radiation to warm 1 ft^3 water 0.33°C every minute assuming absolutely no shade is available from local vegetation at any point during the day. On average, the stream flow is approximately 90 ft^3 per minute.

Small openings in old growth stands are common; and localized warming as a result of the proposed gaps are expected to result in similar conditions remaining within the range of natural variability (Warren 2013). Most studies relevant to shade recovery after clear-cut and other “heavy” harvests predict substantial return to pre-harvest levels within 5–7 years of treatment (Brown 1970; Feller 1981; Harr 1988). These recovery predictions assume the rapid return of bankside understory vegetation, because canopy shade provided by second-growth forests will require 10–20 years (Beschta 1987, Johnson 2000). It is estimated that the canopy openings in these gaps would likewise be transitory and re-vegetate. In addition to protection for excessive thermal loading, the proposed gaps are in streams flowing through locations where hyporheic exchange can provide additional offsets to warming.

There are eight proposed temporary class 4 (intermittent) and 6 class 3 (perennial non-fish bearing) stream crossings as part of Alternative 2 and 3 treatment activities. Class 4 streams are dry during the summer when water temperature is typically a concern. When there is water in the streams however, the width of the clearing needed to establish the crossings would not create a detrimental change in temperature or shade because the primary and secondary shade zones of the surrounding riparian area would retain sufficient canopy closure to provide shade to these narrow streams, and because the topographic location further enhances protection from solar radiation. A few short segments of other temporary roads will enter the outer portion of the Riparian Reserves but not cross any streams. This would allow for historically compacted areas to be re-used then properly sub-soiled and re-vegetated. The reduction in canopy closure of the secondary shade zone is taken into account in the overall calculations of canopy closure on Riparian Reserve thinning treatments. Based on implementation of the design features outlined in Chapter 2, which reduce the acres of disturbance due to temporary roads and skid trails as well as field observations during project reconnaissance; a minimal direct effect is anticipated at a localized level within a few feet downstream of the temporary road crossings.

Additional road decommissioning and storage analyzed under this DEIS are expected to be accomplished within the subwatersheds during the time period of this project and its direct effects. In general, these activities help restore streamside vegetation which would provide additional shading of streams previously impacted by human activities.

Streamside gap treatments and subsequent monitoring were informally consulted upon with Oregon Department of Environmental Quality to assure their approval (Wright, 2014). Stream no-harvest buffer widths and retention of canopy cover were designed to minimize effects to stream temperature. Minimal direct effects may occur at a small/localized level within a few feet downstream of the gaps and temporary road crossings, but the impact to a stream reach would be negligible.

No long-term (> 5-10 years) increases of stream temperature are anticipated within the project area as a result of these alternatives. Consequently, as in the No Action Alternative, water temperatures of streams within the project area would continue to recover toward more natural levels as riparian vegetation re-grows and re-establishes streamside shade. Where Riparian Reserves are actively managed, a minimum of 50 percent canopy closure (approximately 40 percent canopy cover) is preserved in the outer portions (outside the no-harvest buffer) to help protect microclimate also. Many of the treatment units are over-stocked plantations with small diameter riparian trees. Thinning within the secondary shade zone would increase growth of the remaining trees. Additionally, thinning of dense stands and managing fuel loading helps reduce the risk of high severity wildfire. This, in turn, reduces the risk of impacts to stream shade and microclimate.

Cumulative Effects

All recent and planned timber harvest and hazardous fuels reduction projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to stream temperature. Each of the past projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix F) were analyzed for effects to stream temperature and were found to have no effect or a slight beneficial effect from road decommissioning.

3.3.7 Affected Environment – Stream Flows/Disturbance History

Projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage or ARP, as specified by the Forest Plan. The ARP model compares the acres of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed and are intended to represent a minimum safe level of vegetative recovery in the sub-watersheds to prevent significant alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters average more than 8 inches dbh (diameter breast high) and crown closures exceed 70 percent. The analysis is based on data extracted from the Forest's VEGIS database, which includes information about all past harvest activities in the sub-watershed. Currently, ARP levels in the South Fork watershed are far above the Forest Plan Midpoints.

3.3.8 Environmental Consequences – Stream Flows/Disturbance History

Direct and Indirect Effects

Alternative 1 – No Action

Current ARP values are well above midpoint. Alternative 1, No Action, would result in no changes to existing peak flows based on vegetation removal. However, several miles of roads are in poor condition and funnel water to stream crossings or into alternative drainages. These alterations to stream flows would not be improved with the implementation of this Alternative due to the lack of road maintenance, storage, or decommissioning. However, the effect would be localized to a few yards down-stream in most cases.

Alternative 2 and 3

Table 21 summarizes levels of recovery immediately after implementation of the project for each of the alternatives. Completion of implementation is estimated to occur by 2022. The Midpoint ARP value varies by sub-watershed and ranges from 70-80. Since 80 would provide the highest protection, both action Alternatives are compared to that value rather than 70.

Table 21. Aggregate Recovery Percentage for the Green Mountain Project

S. Fork McKenzie Subwatersheds: 170900040302, 170900040303, 170900040304, 170900040307, 170900040308	Alternative 1 (No Action)	Alternative 2	Alternative 3	Max Midpoint ARP
Pre-project (2014)	89.2	89.2	89.2	80
2020 Post-project Estimates	92.7	89.0	89.6	80

ARP levels are maintained above recommended values for all alternatives in the affected sub-watersheds even immediately after implementation when the potential for adverse impacts to vegetation would be greatest. Therefore, no altered peak stream flows are anticipated from implementation of the proposed actions.

Additionally, several miles of roads are currently in poor condition and funnel water to stream crossings or into alternate drainages. These alterations to stream flows would be improved and upgraded with the implementation of this Alternative. However, the effects would be localized to a few yards downstream. Overall, there would be no adverse impact to stream flow timing or duration through the implementation of these alternatives.

Cumulative Effects

ARP levels will remain well above the midpoint so effects to peak flows throughout the watershed are not expected by vegetation removal. Each of the past and future projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix F) were analyzed for effects to peak flow and were found to have no effect or a slight beneficial effect from road decommissioning.

3.3.9 Affected Environment – Sedimentation

Direct and Indirect Effects

The majority of the geologic terrain and soils within the Green Mountain project area are not inherently prone to extensive erosion unless disturbed as discussed in the Soils Specialist Report (located in the project file). Though much of the project area has stable geology, there are areas of earth flow terrain and other unstable geologic features. Roads on earth flows or the more deeply dissected slopes above the river terrace employed construction methods such as cut and fill that resulted in relatively unstable road beds.

Since implementation of the Willamette National Forest Plan in 1990, road maintenance activities have worked to eliminate many of these unstable fill situations. Even so, roads continue to be the largest source of human-caused sedimentation in the project area, and a few old roads still carry water during winter storm events, essentially extending the stream system and occasionally diverting flow from natural stream channels. Additional impacts to streams within the project areas include degrading old log culverts, sedimentation from old skid roads, failing culverts, and displacement from steep road cut-banks along the main-stem of the South Fork McKenzie. Other stream reaches have been completely covered by historic logging debris. The watersheds in the project area have road densities ranging from 0.1 to 2.5. These road densities were calculated using total road miles (open and closed roads) per subwatershed. Road densities over 3.5 miles of road per square mile are considered “Not Properly Functioning” (FEMAT 1993). Though road densities in Cougar, Rebel, and Roaring subwatersheds are high, they are still considered “Properly Functioning” (Table 22).

Table 22. Total Road Densities Across the South Fork McKenzie Watershed

Subwatershed	Road Miles	Subwatershed sq. mi.	Density
Cougar	76.25	30.43	2.5
East Fork	27.95	20.21	1.4
French Pete	3.16	31.26	0.1
Rebel	61.57	26.51	2.3
Augusta	59.29	29.19	2.0
Elk	7.51	48.69	0.2
Roaring	46.58	19.98	2.3

In addition, past timber harvest methods resulted in compaction levels varying from 9 percent to 15 percent for most of the units of harvested with ground based logging systems. However, a few units were approaching the 20 percent maximum allowed by the Forest Standards and Guidelines (Soils Specialist Report). With increasing levels of compaction, there is an increased risk of surface erosion.

Based on observations of existing road conditions during field reconnaissance for the project, sediment outputs from roads were estimated using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The current sediment yield from roads is estimated at 260 cubic yards per year for the project area. Actual yields cannot be accurately calculated since there are numerous annual and inter-annual variations that would need to be considered including weather conditions, timing of peak flow events, etc. Research comparing WEPP estimated sediment rates to actual rates has shown the model to over-estimate values. Therefore sediment predictions using WEPP modeling should only be used for relative comparisons between alternatives rather than actual values expected to be produced.

3.3.10 Environmental Consequences – Sedimentation

Direct and Indirect Effects

Alternative 1 – No Action

Rates of road related sediment yield were estimated to remain relatively constant under Alternative 1 (No Action), reflecting no specific changes due to the lack of road upgrades. Alternative 1 would not correct existing road erosion problems which result in chronic sedimentation to streams. Without timber harvest related road maintenance, the existing budgetary trend would result in only the main roads being maintained. Culverts that are not maintained could plug and cause washouts. The resulting sediment plumes could be detrimental to fish and amphibians. Over several decades, these road issues would stabilize as the disturbed areas re-vegetates. However, no project-related storage or decommissioning would occur. Harvest activity on the portion of private land within the project area would continue, as would use of shared roads. Table 23 below provides a comparison of sediment outputs between all Alternatives.

Alternatives 2 and 3

Past human activities have resulted in altered sediment regimes along many of the streams. Hydrologically disconnecting roads by installing or improving road drainage features is a fundamental practice for eliminating chronic water quality impacts from roads and other disturbances. As a minimum, these activities would include maintenance of proper drainage through maintaining existing structures, installing water bars, or restoring natural drainage features. Installation of new ditch-relief culverts and replacement of existing ditch-relief culverts that are currently in poor condition would also be included. These actions would reduce the likelihood of sediment leaving the road through runoff by reducing the average distance between drainage structures and consequently, the amount of water that each structure needs to handle. Less water on the road translates to less sediment-carrying capacity.

Road work associated with the Green Mountain Project would also include replacement of a number of culverts that are currently in poor repair or inadequately sized to pass 100-year flood flows (Q100). These culverts currently pose an elevated risk of fill failure. Discussion with engineering personnel indicated that the average fill volume is around 250 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culverts fail.

However, replacement would require in-stream work in these locations. Work would be done during non-flow periods for intermittent streams, and engineering practices such as providing for sediment barriers and flow bypass would minimize impacts on perennial streams. Flows in perennial streams are all expected to be less than 1.0 cubic feet per second when work occurs, based on personal observation during project reconnaissance. It is not possible to do this work without some sediment delivery, and accurate estimates are not predictable. Depending on weather behavior and other variable factors, sediment yields should fall between 0.5 and 1.5 cubic yards per installation based on professional experience. This sediment would settle out within a few feet and is not in amounts that would harm aquatic insects or amphibians.

An analysis of estimated sediment outputs from roads in the project area was completed using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The same analysis was conducted for each alternative incorporating all project related road maintenance, temporary road construction activities, and haul route activity. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. Table 23 shows the estimates of sediment production rates based on WEPP.

For both of the action alternatives, annual sediment yield increases during harvest activities. This represents an incremental 12-25 percent increased contribution of sediment that cumulatively adds to sediment already produced under the existing road system. Alternative 2 shows the highest increase during operations when there is increased traffic on haul routes and freshly established temporary roads. By implementing the activities associated with the Green Mountain project, overall human caused sediment input would decrease only slightly (< 5 percent) from current levels.

Table 23. Estimates of Sediment Production Rates for Green Mountain Project Area Roads

	Alt 1 (No Action)	Alt 2 (during harvest)	Alt 2 (after harvest)	Alt 3 (during harvest)	Alt 3 (after harvest)
Gross Sediment Yield (yrd^3)	260	325	249	291	248
Net increase/decrease	-	65	-11	185	142
% increase/decrease	-	25	-4	12	-5

Approximately 10.3 miles of temporary road construction would occur with Alternative 2 and 8.6 would occur in Alternative 3. However, only 2.3 and 2.1 miles would be proposed within Riparian Reserves. These represents approximately 11 acres of ground disturbance. All temporary roads would be stabilized with erosion control measures as necessary for the wet season to minimize accumulation of runoff and transport of sediment and would be fully decommissioned after the project is complete. In addition, 3.5 miles of road decommissioning and 21.1 miles of storage are proposed in both action Alternatives and would reduce current sediment inputs. Decommissioning would include activities such as the removal of culverts, ripping or recontouring of the road surface, and revegetation. Based on professional experience, each fill removed would produce on average <1 cubic yard of fine sediment that would leave the fill removal site and settle out in the first 100 feet below the fill removal during the first winter.

Table 24 below provides a summary of the culvert replacements and the potential amount of stabilized fill material that would have a reduced risk of entering streams. It also estimates the amount of sediment produced from the culvert replacements. Based on professional experience, each fill removed would produce on average <1 cubic yard of fine sediment that would leave the fill removal site and settle out in the first 100 feet below the fill removal during the first winter. The maximum estimate of sediment yields from the culvert replacements would be approximately 170 cubic yards for Alternative 2. In comparison, the estimated volume of fill stabilized is 23,310 cubic yards for Alternative 2. While the maximum sediment yields for culvert replacements would be approximately 156 cubic yards, and 21,540 cubic yards for Alternative 3. Either Alternative 2 or 3 would reduce the potential for runoff effects and culvert failures that may affect Riparian Reserves or water quality.

Table 24. Approximate Culvert Replacements in Perennial and Intermittent Streams by Alternative for the Green Mountain Project

	Stream Type	Number of Culverts Installed/Replaced/Removed	Cubic Yards of Fill Stabilized	Sediment Yields from Culvert Replacements (Cubic Yards)
Alternative 1 (No Action)	None	0	0	0
Alternative 2	Intermittent	65	12,350	32.5 - 97.5
	Perennial	40	10,000	20.0 - 60.0
	Log culvert	8	960	4.0 - 12.0

	Stream Type	Number of Culverts Installed/Replaced/Removed	Cubic Yards of Fill Stabilized	Sediment Yields from Culvert Replacements (Cubic Yards)
	Total	113	23,310	56.5 - 169.5
Alternative 3	Intermittent	57	10,830	28.5 - 85.5
	Perennial	39	9,750	19.5 - 58.5
	Log culvert	8	960	4.0 - 12.0
	Total	104	21,540	52.0 - 156.0

Most harvest-related sediment input to streams comes from skid trails, historic roads that were poorly located, historic log culvert crossings, or historic skyline corridor crossings. Research has shown that by keeping these at least 33 feet from streams and following BMP guidelines, essentially all of the harvest related sediment is eliminated (Roshin 2006, Lakel 2010). In addition, as discussed in the Soils section of this document, soils in the project area have naturally high rates of infiltration and low potential for overland flow. The Design Features for Alternative 2 and 3 designates additional equipment exclusion zones around streams and wetlands will essentially eliminate any routing of water from the logging operations (see Appendix G). Likewise, sediment impacts from near-stream gap creation would be minimized by leaving bank-stability trees and using BMPs when designing the yarding of the cut trees into the outer portions of the Riparian Reserve.

The McKenzie River Sub-Basin, including the Green Mountain project area, provides municipal water to the City of Eugene by way of the Eugene Water and Electric Board's intake at Hayden Bridge, approximately 60 miles downstream from the project area. Sedimentation and associated turbidity are the most likely consequences of the Green Mountain Project that could adversely affect municipal water quality; but with the design features that restrict the location of skid roads and temporary roads as well as best management practices and the buffering effect of Cougar Reservoir, adverse effects are not anticipated.

Natural annual pulses of sediment will continue. In some years the sediment input will be greater than in other years, but overall the sediment input levels are expected to remain near current levels until a large flood event occurs. However, the risk of road and fill failures during major storm events would be reduced. With the additional activities that would be part of the Green Mountain project, overall anthropogenic sediment input would decrease slightly across the 6th field watersheds.

Cumulative Effects

Alternatives 2 and 3

All recent and planned timber harvest, riparian habitat complexity development, and road decommissioning projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix F) were analyzed for effects to sediment and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the minor impacts expected from the Green Mountain project during timber haul and culvert replacement would not measurably contribute to impaired aquatic conditions.

Ongoing timber haul on private lands as well as annual road maintenance would continue into the foreseeable future throughout the watershed. However, private lands are under the jurisdiction of the

Oregon Forest Practice Rules which requires a different set of standards and BMPs to reduce sedimentation into the waterways.

3.4 Aquatic Resources (Fisheries and Aquatic Insects)

3.4.1 Scale of Analysis

Unless otherwise noted, the geographic scale used to assess direct, indirect, and cumulative effects for fisheries and aquatic insects includes project activity units, the South Fork McKenzie River 5th field watershed and all the 6th field sub-watersheds in the South Fork. The reason for selecting these scales of analyses is that streams, and in turn fish and their aquatic habitat are directly connected to their riparian areas which in turn are connected to the hill slopes within the watershed. In addition, satellite imagery was used to conduct a “hardwood analysis” for all the Riparian Reserves in the South Fork McKenzie River 5th field watershed.

3.4.2 Affected Environment

The Green Mountain project is distributed across the western and southern portions of the South Fork McKenzie River watershed and all units are upstream of Cougar Dam. Primary streams within the project area include the South Fork McKenzie River, Elk Creek, Roaring River, Augusta Creek, Grasshopper Creek, Loon Creek, Starr Creek, Hardy Creek, Buoy Creek, Ridge Creek, Rider Creek, and Boone Creek. There are also numerous non-fish bearing streams located in the project area.

A variety of fish species can be found in the South Fork McKenzie River as illustrated in Table 25 below.

Table 25. Fish Species of the South Fork McKenzie River and its Tributaries (USDA Forest Service 1994)

Common Name	Scientific Name
spring Chinook salmon*	*Oncorhynchus tshawytscha*
coastal cutthroat trout*	*Oncorhynchus clarki clarki*
rainbow trout*	*Oncorhynchus mykiss*
bull trout*	*Salvenlinus confluentus*
mountain whitefish*	*Prosopium williamsoni*
Pacific lamprey	*Entosphenus tridentatus*
longnose dace	*Rhinichthys cataractae*
speckled dace*	*Rhinichthys osculus*
redside shiner*	*Richardsonius balteatus*
largescale sucker*	*Catostomus macrocheilus*
sculpin species*	*Cottus spp.*

*confirmed sighting

Coastal cutthroat trout are ubiquitous in the project area. They can be found in small tributaries, in the South Fork McKenzie River, and in Hidden Lake. Rainbow trout tend to be seen in larger tributaries and in the South Fork McKenzie River. Spring Chinook salmon are primarily found in the South Fork but can also access lower Augusta Creek, lower Roaring River, and lower Elk Creek to use as spawning and rearing habitat. The only stream in the South Fork that is suitable for bull trout to use as spawning and early rearing habitat is Roaring River and this is because of its cold stream temperatures due to ground water inputs from springs. When bull trout get older (2 to 3 years old) they enter the South Fork to rear and prey on other fish species. As adults (5 years and older), bull trout use the South Fork and Cougar Reservoir as rearing habitat.

Cougar Dam has acted as a migration barrier to fish since its construction in the early 1960’s. The U.S. Army Corps of Engineers (USACE) constructed a “trap and haul” facility at the base of Cougar Dam in 2010 and have been moving fish upstream of the dam since that time. The USACE and the Oregon Department of Fish and Wildlife (ODFW) have a goal of moving a minimum of 600 adult spring Chinook salmon upstream of the dam. If less than 600 spring Chinook are captured at the dam, then ODFW will supplement with salmon captured at the McKenzie River Hatchery.

Presently there is not safe downstream passage at the dam. The USACE is studying downstream passage at the dam using a “portable floating fish collector.” The study will determine if this would be a safe and effective way to get juvenile salmon downstream of the dam.

Three aquatic insects found on the Regional Forester’s sensitive species list (SSL) have been documented on the Willamette National Forest. These aquatic insects are all caddisflies and little is known about them. In fact, the common name for all of these caddisflies is “A Caddisfly.” A short summary of the distribution and known habitat associations is provided below. For a more detailed discussion on these species, see the Fisheries Biological Evaluation (available in the project files upon request).

Rhyacophila chandleri: In Oregon, this species is documented on Willamette, Deschutes, and Umpqua National Forests. It is documented on the Willamette National Forest as a rare insect on the H.J. Andrews Experimental Forest. The entire *Rhyacophila* genus, whose name is derived from the Greek roots rhyaco (stream or torrent) and philia (fondness), is confined to running water. In the Cascade Mountains of Oregon, this species is associated with very cold, larger spring-fed streams (USDA Forest Service and USDI Bureau of Land Management 2012a). Elevations of known populations range from around 1219 to 1700 m (4000 to 5600 ft.) in Oregon.

Rhyacophila leechi: In Oregon, *Rhyacophila leechi* is documented to occur on the Willamette National Forest and on Bureau of Land Management land in the Medford District. *Rhyacophila leechi* adults have been collected from springs and cold, spring-fed streams. This species appears to require colder water temperatures than the common and more widely distributed *Rhyacophila. verrula*, and is likely confined to smaller, headwater streams and springs (USDA Forest Service and USDI Bureau of Land Management 2011). Oregon sites range in elevation from 440 to 980 m (1444 to 3210 ft.) (USDA Forest Service and USDI Bureau of Land Management 2011).

Namamyia plutonis: On National Forest System and Bureau of Land Management lands, documented occurrences are from the Rogue River-Siskiyou, Siuslaw, and Willamette National Forests (USDA Forest Service and USDI Bureau of Land Management 2010). The majority of the documented occurrences are between 30 and 50 years old.

Sampling for aquatic insects (macroinvertebrates) has taken place in the South Fork McKenzie River watershed. In 2005 and 2006 samples were taken above Cougar Dam and below the dam. Members of the genus *Rhyacophila* were collected in both places but neither of the species found on the sensitive species list (SSL) was documented in those efforts. In 2004, samples were taken in the East Fork of the South Fork McKenzie River and in Walker Creek. As with the other samples *Rhyacophila* were collected but not the species on the SSL. No members of the genus *Namamyia* were found in any of these samples.

Despite not finding the species on the SSL the South Fork McKenzie River and Roaring River provide the type of habitat that *Rhyacophila* requires for survival (i.e. large spring-fed rivers) so that habitat is treated as potentially occupied. *Namamyia plutonis* tend to be found associated with small streams in densely forested old growth or mature forest watersheds (USDA Forest Service and USDI Bureau of Land Management 2010).

More information and description of the existing condition for Riparian Reserves can be found in the hydrology and soils section of this DEIS. In the project area Riparian Reserves can be found in variety of conditions from 29 year old stands of dense Douglas-fir monocultures (i.e. plantations) to mature and old growth stands that have a greater diversity of tree species and light availability to the stream ecosystem. Given the size of the project area, Riparian Reserves are found along a variety of water bodies including seasonal flowing streams, perennial flowing non-fish bearing streams, fish bearing tributaries and a small river (the South Fork), small ponds, and a large “sag pond” (Hidden Lake).

Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al, 1997; Poage and Tappeiner 2002). There are some plantations that have over 1,800 total trees per acre (i.e. all trees in the stand including those under 7 inches in diameter). Post-harvest thinning densities in Riparian Reserves would range from a residual of approximately 50 trees per acre to approximately 111 trees per acre with the average stand having approximately 84 trees per acre. All Riparian Reserves where thinning is proposed would have a no cut buffer (see Appendix G for specific information on each unit) and thinning would maintain 40 percent canopy cover in the rest of the reserve. The Riparian Reserves are thinned to a 40% canopy cover in the treated portion (50% canopy closure). The Forest Vegetation Simulator (FVS) model was used to determine the residual number of trees as a derivative of the crown width and desired canopy cover. The default FVS canopy equation was used rather than trying to compensate for overlap of crowns, which has resulted in canopy covers that typically exceed the desired condition. Stands with lower initial stand densities would have larger / wider crowns which would result in fewer trees necessary to attain the residual canopy cover of 40% in the Riparian Reserve. This is why there is such a range in residual trees per acre.

Some Riparian Reserves in plantations have a good mix of hardwoods in the stand so no treatment was recommended in those areas. These stands appear to be on their way to achieving Aquatic Conservation Strategy objectives without any need of silvicultural activities. As an example, the following units have non-fish bearing perennial streams in them and the Riparian Reserves stands have diverse vegetation so a 180 foot no cut area is recommended on each side of the creek: 220, 230, 240, 290, 300, 310, 330, and 350. These stands range in age from 30 to 42 years old and the stream systems drain into Cougar Reservoir.

Some Riparian Reserves in plantations did not have a good mix of hardwoods in the stand so silvicultural treatment is recommended in those areas. These stands are dense, dark plantations of almost pure Douglas-fir with either very few hardwoods in the Riparian Reserve or none at all and very little sunlight reaching the forest floor or the stream channels. These conditions were verified using satellite imagery and on the ground field investigations. In some cases thinning is recommended and in a few stands non-commercial “near stream gaps” are proposed. In these quarter acre gaps near the stream all trees would be felled and left on site. These sites would be monitored to ensure that hardwood trees colonized the site. It is expected that within 6 to 10 years there would be a stand of hardwood trees on the site. If necessary the gaps would be planted with hardwoods (i.e. vine maple, big leaf maple, and red alder). Units where near stream gaps are recommended are: 420, 430, 440, 500, 530, and 600. These stands range in age from 28 to 36 years old and the stream systems drain into Cougar Reservoir.

On two streams it is proposed to fall and leave trees in the channel. Table 27 summarizes where these proposed treatments would take place.

Table 26. Proposed Units with In-stream Fall-and-Leave Treatments

Stream Name/Class	Unit	Treatment Description
Pass Creek, Class 2 (Cutthroat trout stream)	5080	Fall conifers into channel every 50-100 feet alternating sides and avoid bank trees
	5230	
Elk Creek, Class 1 (Chinook salmon stream)	5420	Fall conifers into channel every 50-100 feet alternating and avoiding bank trees. Every 200-400 feet, fall 5-10 trees into the channel as a clump.
	5440	
	5460	
	5470	

Pass Creek is a tributary to Augusta Creek and is inhabited by coastal cutthroat trout. It is a relatively small stream and relatively steep (8 percent gradient and steeper). Elk Creek is a tributary to the South Fork McKenzie and is a larger system than Pass Creek. Its first two reaches are relatively flat (3 percent to 4 percent gradient) and the valley is wide (500 feet wide). There was very little large woody material in Elk Creek (Table 27) and in the two reaches outside the wilderness there was evidence of salvage logging large trees that were in the creek. Surveyors observed numerous “root sprung” trees next to the creek but the tree had been cut from the rootwad and salvaged. Elk Creek is capable of providing habitat for cutthroat, rainbow, and Chinook salmon due to its cold stream temperatures but is lacking large woody material in the stream.

Table 27. Woody material counts for some streams in the Green Mountain Project Area

Stream	Reach	Wood/Mile Small/Medium/Large	Wood/Mile Medium/Large Only
Ridge Creek (1993)	1	441	334
Loon Creek (1994)	1	237	59
Hardy Creek (1998)	1	78	17
	2	116	28
	3	71	16
Buoy Creek (2001)	1	18	1
	2	19	2
Augusta Creek (2003)	1	79	23
	2	76	23
	3	105	35
	4	156	85
Elk Creek (2001)	1	27	0
	2	30	1
	3*	124	3
	4*	18	0

*These reaches are in the Three Sisters Wilderness
Small – are at least 12 inches in diameter at 25 feet from the large end.
Medium – are 24 inches to 36 inches in diameter at 50 feet from the large end.
Large – are greater than 36 inches in diameter at 50 feet from the large end.

Projects to add large wood material to the South Fork McKenzie River channel have been implemented since 1995. Since that time 841 trees or logs have been placed between Augusta Creek and Elk Creek, and in lower Roaring River. As of 2014, most of this wood has accumulated into large log jams and is providing excellent rearing habitat for fish in the South Fork.

3.4.3 Environmental Consequences

Salmonid fishes (salmon, trout, chars, and whitefish) and the caddisflies on the sensitive species list can all be affected by changes in the supply and delivery of large woody material to the stream channel, changes in stream shade that can increase stream temperatures, changes to the sediment regime, and vegetative diversity in the Riparian Reserve especially diversity of trees. Therefore, these habitat attributes are analyzed to determine the effects of proposed activities to Salmonid fish (a management indicator species) and listed caddisflies.

Methods used for analysis included:

- field reviews of the units,
- a review of stream surveys in the project area,
- a review of the South Fork McKenzie River Watershed Analysis (USDA Forest Service 1994) for pertinent information,
- a “hardwood analysis” at a landscape level for Riparian Reserves in the South Fork McKenzie River watershed. For this analysis satellite imagery (WorldView 2) collected on July 19, 2013 was utilized. See Appendix H for further discussion on methodology and results,
- a review of macroinvertebrate data collected in the South Fork McKenzie River watershed,
- a review of other specialist reports,
- project design features,
- the implementation of best management practices (BMPs)

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 (No Action) would have no immediate effect on riparian conditions. However in the stands that are comprised of dense monocultures of Douglas-fir it would increase the risk of loss of riparian stands to fire, insect infestation, and disease – all carried more efficiently through dense riparian stands common in plantations. Relative to stands that are regenerated by fire these plantations are dense and without some sort of disturbance they will grow in tightly spaced conditions which will lead to tall spindly trees with limited crown development. In some plantations with diverse vegetation, ecological succession will continue and the stands will diversify structurally through time and eventually become old growth. In the fire regenerated stands where riparian conditions are better due to increased species diversity, fewer trees per acre, and structural diversity this habitat would be maintained. These Riparian Reserves will become old growth in time as well unless a natural disturbance (fire or flood) sets back ecological succession.

Nutritional energy becomes available to the stream community from two main sources: photosynthesis by aquatic plants in the stream itself (autochthonous sources) and decomposition of organic matter imported from outside the stream (allochthonous sources) (Murphy and Meehan 1991). The mix of energy sources has a major influence on the structure and function of stream ecosystems. Streamside vegetation provides large quantities of organic matter in the form of leaves, needles, and woody material. Leaves and needles usually contribute most of the readily usable organic matter in woodland streams (Table 28) (Murphy and Meehan 1991).

Leaves decay in four phases: they are leached by water, conditioned by microbes, and shredded by invertebrates and physical abrasion. Then residual fine particles are recycled within the benthic food chain by microbes and invertebrates. Rate of decay depends on chemical composition and is directly related to temperature. Generally, the greater the nitrogen and phosphorus content, the faster leaves and needles decay (Murphy and Meehan 1991).

Most animals require food with a carbon to nitrogen (C:N) ratio less than 17:1(Murphy and Meehan 1991). During the first few days after a leaf enters the stream ecosystem, leaves lose about 15 percent of their weight as soluble matter that is leached into the stream. With a C:N ratio less than 5:1 leachate is highly liable and about 80 percent is quickly assimilated by stream bacteria. Leachate is taken up faster from deciduous leaves than from coniferous needles. Almost all (98 percent) red alder leachate is removed from the water within two days, whereas only 35-60 percent of Douglas-fir is removed in that time. This means that most leaf leachate is retained and rapidly processed in headwater streams, but some moves downstream without much processing (Murphy and Meehan 1991).

Leaves and needles need to be conditioned by microbes for about 30 days before invertebrates will consume them. Conditioning increases concentrations of nutrients in leaf detritus because microbes use nitrate and phosphate from stream water and carbon compounds from the leaf to build their own proteins thereby decreasing the C:N ratio of the detritus (Murphy and Meehan 1991). Almost all forms of allochthonous organic matter have a C:N ratio higher than 17:1 so they require microbial processing to enhance food quality. The quality of various forms of organic matter varies widely as measured by the C:N ratio or the percentage of lignin. At the low end of the spectrum are woody debris and conifer needles and at the high end are periphyton, macrophytes, and fast-decaying deciduous leaves (Murphy and Meehan 1991).

Table 28. Nutritional quality of various types of organic matter (from (Murphy and Meehan 1991)

Type of organic matter	C:N ratio	Lignin (percent)
Woody debris (Douglas-fir)		
Twigs	235:1	34
Bark	324:1	10
Wood	1,343:1	48
Needles	97:1	14
Leaves		
Red alder	23:1	10
Big-leaf maple	62:1	17
Vine maple	77:1	8
Aquatic macrophytes	8:1	
Periphyton	1-11:1	

In the plantation units that are heavily stocked with monocultures of Douglas-fir, Alternative 1 will perpetuate the continued delivery of organic material that is of lower quality than that provided by hardwoods. In plantation units where a mix of hardwoods and conifers was observed, and in fire regenerated stands, a beneficial variety of organic matter will continue to be delivered to streams. Relative to the Riparian Reserves where little or no hardwoods were observed, this variety of allochthonous material would provide a diverse set of materials available to the stream community as sources of energy.

The larval behavior and diet of *Rhyacophila chandleri* and *Rhyacophila leechi* are not known, but are probably similar to others in the *Rhyacophila verrula*-group. While most Rhyacophila larvae are obligate predators, feeding on aquatic invertebrates, members of the verrula-group are unique in having phytophagous diets (i.e. feeding on plant material) consisting largely of filamentous algae, diatoms, detritus, bryophytes, liverworts, and/or other non-animal material (USDA Forest Service and USDI Bureau of Land Management 2011 and 2012).

Not much is known about the specific life history of *Namamyia plutonis*. Most caddisflies are herbivorous and feed on algae, small pieces of plant material, and decaying plant tissue (USDA Forest Service and USDI Bureau of Land Management 2010). The caddisflies on the SSL would benefit from a greater variety of organic material delivered to the stream that would be provided from near stream gaps.

Alternative 1 will have a range of effects on fish species and aquatic insects due to the effects of sediment. Rates of road related sediment yield remain constant under Alternative 1, reflecting no specific changes in ongoing road treatments or conditions. Alternative 1 would not correct existing road erosion problems or old log stream crossings that were found in some of the units reviewed. These old log crossings are acting as chronic sources of sediment to perennial non-fish bearing streams. For example, units 420 and 430 had numerous log crossings on the streams and one road without a culvert on a stream crossing. The non-fish bearing streams in turn were filled with fine sediment in these units. Without timber harvest related road maintenance and trust funds, the opportunity to remove old log stream crossings would be limited and adverse conditions would continue. The existing budgetary trend would result in only the main roads being maintained and makes it unlikely that funding would be available to support adequate road maintenance, which results in chronic sedimentation to streams. Culverts that are not maintained could plug and cause washouts. The resulting sediment plumes could be detrimental to fish and aquatic insects. Over several decades, these road issues would stabilize as the disturbed areas re-vegetate. However, no project-related storage or decommissioning would occur. Harvest activity on the portion of private land within the project area would continue, as would use of shared roads.

Depending on when and where road failures occurred it could have little direct effect on fish or adverse effects on fish and their habitat. For example, if the road failure was on a crossing adjacent to the South Fork McKenzie River it could impact spring Chinook redds directly if the road related sediment ends up on a redd (an egg nest constructed by a Salmonid fish). Even if it does not end up on a redd, it could indirectly impact spawning habitat for a season or more depending on the size of the failure. This impact would be to increase the amount of fine sediment in the redd which could adversely affect fish survival. However, the South Fork McKenzie does not appear to be sediment rich or have an aggraded channel. With the exception of large woody material levels the habitat is for the most part in great condition with spawning gravels well sorted on pool tail-outs and there does not appear to be so much fine sediment that salmonid redds are currently being adversely affected.

Alternative 2

The hydrology and soils section of this DEIS provides a break down on acres and treatments proposed in Riparian Reserves in the project area. No treatments are prescribed for Riparian Reserve stands that are fire regenerated. A variety of treatments are prescribed for Riparian Reserves in plantations. These include: no treatment, thinning, gaps in the secondary shade zone, streamside adjacent gaps, and fall and leave in two fish bearing streams. The gaps that are adjacent to streams are non-commercial and all the trees would be felled and left on site.

There is uncertainty in the scientific literature regarding management actions in Riparian Reserves especially when it comes to coarse woody material. For example, if silvicultural treatments are needed to attain desired vegetation characteristic in order to achieve Aquatic Conservation Strategy (ACS) objectives, what is the appropriate buffer width to protect aquatic organisms? Sweeney and Newbold (2014) conducted a scientific literature review that asked the question "how wide" a streamside forest should be to assure a natural setting for the stream, protect water quality, and enhance stream and river ecosystems and ecosystem services. In their review they were unable to find any publications addressing the issue of streamside forest width and the input of large woody debris to streams. They concluded that in lieu of direct studies bearing on this issue, they could infer at this time that a streamside forest can best provide a natural level of large woody debris to streams if its width is generally about 30 meters (98 feet) or equal to the height at maturity of the dominant streamside trees (Sweeney and Newbold 2014). The ACS bases Riparian Reserve widths on "site potential tree heights" and in the South Fork McKenzie River that is 180 feet for a Douglas-fir. Standard and Guideline TM-1(c) in the Northwest Forest Plan (1994) provides direction on when silvicultural activities can take place in Riparian Reserves. The task is to review all the Riparian Reserves in the project area and at the landscape level to determine if treatment is warranted. Based on field investigations and a landscape level analysis of hardwoods in the South Fork McKenzie watershed recommendations were developed for each Riparian Reserve (Appendix G).

There are some studies that have looked at the effects of thinning and gaps on riparian and aquatic habitats. One study by Wilzbach and others (2005) looked at the production of resident fish (rainbow and cutthroat trout) by adding salmon carcasses and by removing all the red alder and other hardwoods on both sides of the stream along a 100 meter (328 feet) reach. One of their findings was that in light-limited settings where temperature gains associated with canopy opening are not problematic for aquatic resources, gains in salmonid production might be achieved by selective trimming of riparian hardwoods (Wilzbach et. al. 2005). This is not what is being proposed in the Green Mountain project (i.e. removing all hardwoods). In fact, the concern with some of the Riparian Reserves in the project area is that there are little to no hardwoods and at the landscape level only 3.2 percent of the acres in the Riparian Reserve land allocation are "deciduous, and deciduous shrub" (see hardwood analysis in appendix H). By creating small gaps (e.g. a ¼ acre) along certain streams we expect that hardwoods will colonize the site and if they did not, then hardwoods would be planted (e.g. red alder, vine maple, and big leaf maple) to improve the quality of allochthonous sources of energy for the aquatic community.

A recent study by Ruzicka and others (2014) looked at the management of riparian buffers and upslope thinning with downslope impacts. In their conclusion they write that they found an edge effect below upland thinning treatments that extended up to 15 meters (49 feet) into untreated riparian buffers. There was no similar edge effect for trees downslope of gaps. They speculated that this difference could be due to the understory, shrub, and subdominant canopy layers responding more strongly to gap creation than thinning. They stated that their study demonstrates that upland management can be used to influence riparian forests at the upland edge but only to a limited spatial extent. Such management practices may be enough to support the functional goals of riparian buffers such as maintaining potential in-stream coarse woody debris, stream temperature moderation, and nutrient uptake. Finally they found that maintaining lower tree densities directly above riparian areas may be especially beneficial if other methods to increase tree growth and vigor such as thinning are not allowed directly in riparian management areas.

Thinning and gaps in Riparian Reserves are being proposed to improve structural and vegetative diversity, not necessarily for improved tree growth in the no cut buffer as Ruzicka (2014) found. It would, however, be a benefit to some of the stands in very dense plantations where we have prescribed no cut buffers. The gaps they looked at in the study were circular and were 0.4 hectares (0.98 acres) in size and are bigger than what is being proposed in the Green Mountain Project. It is expected that there would be a deciduous and deciduous shrub response in the gaps that would be a ¼ acre in size. This would be beneficial to the stream community by improving the quality of allochthonous sources of energy. It is not expect that stream temperatures would rise significantly because of the small size and limited number of the gaps, the steep gradient of the streams, the hyporheic activity caused by the complexity of cascade habitat, downstream stands where shade will aid in recovery, and the eventual establishment of a hardwood stand that would provide effective shade in 6 to 10 years. Monitoring strategies would be set up to ensure compliance with Oregon Department of Environmental Quality (ODEQ) water temperature standards.

An older study looked at the effects of clear cutting stream side forests which is not being proposed in the Green Mountain project. Murphy and Hall (1981) looked at the varied effects of clear cut logging on aquatic predators and their habitat in small streams in the Blue River watershed and in the South Fork McKenzie River watershed (in Walker Creek). They found that effects associated with logging depended on stream size, gradient, and time after harvest. Clear cut sections where the stream was still exposed to sunlight (5- 17 years after logging) generally had greater biomass, density, and species richness of predators than old-growth (> 450-years-old) forested sections. Increases were greatest in small (first-order), high gradient (10- 16 percent,) streams, where clear-cut sites had both greater periphyton production and coarser streambed sediment than old-growth sites of similar size and gradient. Effects on aquatic predators were mixed in larger, lower gradient streams, where clear-cut sites showed accumulation of sediment and relatively small increases in periphyton production. Second-growth logged sections (12- 35 years after logging), re-shaded by deciduous forest canopy, and had lower biomass of trout and fewer predator taxa than old-growth sites.

Murphy and Hall (1981) also noted a study in the Oregon Coast Range which found mixed effects of logging without streamside buffers on biomass of coho salmon (*Oncorhynchus kisutch*), but consistent reductions in cutthroat trout populations. Thus clear-cutting may be a direct stimulus to secondary production in some regions if other detrimental effects, such as temperature increase, reduction in pool quality, or sedimentation, are not severe. They also hypothesized that the differences in geomorphology and sediment load may explain differing impacts of logging on stream communities. Logging impacts on trout, for example, differ between the Western Cascades and Coast Range in Oregon, perhaps because streams in the Coast Range are often lower gradient and carry more sediment than those in the Western Cascades.

One of the habitat elements that affect stream communities in natural gaps observed in old growth is the structural presence of down wood. The gaps in old growth can be caused by a few large trees blowing down. This leads to a stream gap that has both hardwood and coniferous trees in the gap and large wood in the channel and on the forest floor. The proposal is to emulate these natural gaps in specific plantations (Table 18).by falling and leaving all the trees in the created near stream gap. This will maintain structure in the gap, in the stream, and provide growing space for hardwoods. These changes would be beneficial to aquatic insects by increasing the amount light availability.

Alternative 2 would have limited direct effects on fish. The direct effects would be limited to fish in Pass Creek, and Elk Creek. In each of these creeks it is proposed to fall and leave trees into the stream channel (Table 17). This could adversely impact fish if we fall a tree and it hits a fish and harms or kills it. However, it is believe that mortality from trees falling is unlikely but it could happen. In Pass Creek coastal cutthroat trout inhabit ~~those~~ the stream so they would be the fish affected. In Elk Creek a wider range of fishes can be found including spring Chinook salmon and bull trout. In the short (1 to 10 years) and long term (10 to 50 years) the addition of these trees to the channel will have beneficial effects on fish habitat. Also, the small openings that are created should increase primary production at the site scale and eventually hardwood leaves would become more abundant in these streams providing higher quality nutritional material to the stream community. This would have beneficial effects on the aquatic insect community and eventually the fish community.

There are no cut buffers of varying width (30 feet to 360 feet) prescribed for every stream in the project area. When conducting field investigations the no cut buffer was based on stream size, stream class, stream gradient, channel complexity, and how functional the existing coarse woody material was in the stream channel. It is expected that the amount of coarse woody material left behind in the no cut buffer and the remainder of the Riparian Reserve will be sufficient to sustain physical complexity and stability of the stream channel. Fish bearing streams would have wider buffers (i.e. from 90 to 180 to 360 feet) so thinning in these Riparian Reserves would have limited beneficial effects on fish and caddisflies.

Thinning Riparian Reserves means that there will be an effect on the supply of coarse woody material and ACS objective 8 states that the Forest Service must maintain and restore supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. The plantations where thinning is proposed are dense. The number of trees per acre (TPA) greater than or equal to 7 inches diameter breast height (dbh) ranges from 69 TPA (unit 1980) to 310 TPA (unit 5260). If you consider total trees per acre (TTPA) that includes trees less than 7 inches dbh the range is 315 TTPA (unit 1980) to 1,189 TTPA (unit 5260). Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al 1997; Poage and Tappeiner 2002). Having a no cut buffer adjacent to every stream would maintain a high level of trees per acre compared to what has been found in these studies. In the thinned areas there would still be more trees per acre left after thinning than found in the studies. The previously harvested stands proposed for treatment in the Green Mountain project area were harvested and replanted using direction that pre-dates even the Willamette Land and Resource Management Plan (1990) and prior to the Northwest Forest Plan (1994). As a result, the majority of these forest stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominated stands, with tree densities above the range of natural variability expected in this area.

At a watershed level, coarse woody debris levels will be maintained. There are 65,570 acres of Riparian Reserve in the project area. Alternative 2 and 3 would each thin approximately 1.4 percent of the Riparian Reserve acres in the project area. The action alternatives would create 3.9 acres of gaps which is approximately 0.006 percent of Riparian Reserve acres in the project area. These acreages are small so they would not cause adverse effects at the landscape scale but would have beneficial effects at the site scale.

Another way that fish could be affected directly is by road work. Table 29 shows culvert replacement sites on Forest Road 1900 that are within 150 feet of the South Fork McKenzie. Road 1900 parallels the South Fork McKenzie River and in one spot the road is directly next to the river.

Table 29. Culvert replacement needs on Forest Road 1900 within 150 feet of the South Fork McKenzie

New culvert diameter (min.)	Stream Class	Height of fill to be removed
36”	Intermittent	7 ‘
18”	Perennial	4’
18”	Intermittent	7’
18”	Intermittent	5’
18”	Intermittent	5’

Since all but one of the streams is intermittent it is not expected that sediment from this work would have direct effects on fish in the South Fork. The perennial stream is very small and is all but a trickle during the summer and there is only 4 feet of fill that would be removed and replaced. Indirectly, there could be short term (immediately after the first rain of the season) turbidity effect but larger juvenile and adult salmon and trout appear to be little affected by ephemerally high concentrations of suspended sediments that occur during most storms and episodes of snow melt (Bjornn and Reiser 1991).

A bridge will need to be replaced over Hardy Creek on the 1980204 road. This bridge site is 350 feet away from the South Fork McKenzie, and lower Hardy Creek is designated as critical habitat for Upper Willamette spring Chinook salmon. A piece of equipment will have to cross the creek at least once for this work to happen. No instream work would need to occur and excavation would take place in the existing road prism. If the work is done during the instream work period (July 1 to August 15) there would be no adult Chinook salmon spawning in the stream systems during this period. There could be juvenile Chinook salmon in the South Fork or lower Hardy Creek during the summer period as well as cutthroat and rainbow trout. As discussed above, larger juvenile salmon and trout can handle short term turbidity effects and since excavation would take place in the existing road prism we do not expect turbidity to be an issue. If fish are in the path of an excavator while it crosses Hardy Creek, they would be harassed by the equipment but should be able to swim out of the way. Harassing fish listed on the Endangered Species Act (ESA) is considered “take” and is prohibited without authorization. See the section below on compliance with other regulatory direction for additional information.

There are two activities proposed on Elk Creek that could harass listed fish. First, a temporary bridge would need to be placed over Elk Creek on the 1964480 road. An old hazardous bridge was removed from this site. Most work would be done on the approaches but there might be the need to have a piece of equipment in the channel. Second, falling and leaving trees into the channel would have the potential to have adverse effects in the short-term (days) and beneficial effects in the long-term (decades). These activities would be required to take place during the instream work period (July 1 to August 15) to minimize impacts on fish but the potential for “incidental take” under the ESA still exists so formal consultation will be required. See the section below on compliance with other regulatory direction for additional information.

Alternative 3

The effects of Alternative 3 on fish and listed caddisflies would be the similar to Alternative 2. This is because the riparian treatments are similar and the difference between regeneration acres in the two alternatives is not significant enough to create different effects.

Cumulative Effects

Cumulative effects analysis looks at past, present and reasonably foreseeable actions in relation to the proposed actions and alternatives. The area of analysis for fish and aquatic insect cumulative effects is the South Fork McKenzie River watershed upstream of Cougar Dam. This is because this area of analysis is the most appropriate size when considering if cumulative effects are quantitatively relevant. The timeframes in cumulative analysis can be immediate (1 day) or long-term (a century or more). Specific will be defined below.

Alternative 2 and 3

Each of the past, present and reasonably foreseeable future actions found in Appendix F were analyzed for effects to fish and aquatic insects on the Sensitive Species List. Past timber management projects, Road 19 Danger Tree Removal and Cascade Thin, had effects determinations on fish and caddisflies of “no effect”. The Hartz Reoffer forest management action was recently completed and the effects determination for that project was “may affect, not likely to adversely affect” spring Chinook salmon and bull trout.

Fish habitat enhancement and restoration actions have taken place in the South Fork McKenzie River upstream of Cougar Dam and Reservoir. These actions have taken place in the South Fork McKenzie between Augusta Creek and Elk Creek and in the lower ½ mile of Roaring River. These actions overlap in time and space with Green Mountain. Table 30 shows a summary of trees and logs added to the South Fork McKenzie River and lower Roaring River.

Table 30. Trees and Logs Added to the South Fork McKenzie River and Lower Roaring River

Number of trees or logs added to South Fork McKenzie River and lower Roaring River	Year
191	1996
160	1998
40 key logs tipped into channel	2007
450	2008
841	**TOTAL**

The Green Mountain Project has an effects determination of “may affect, likely to adversely affect” spring Chinook salmon and bull trout. This is due to the potential for “take” (see section below about Endangered Species Act compliance) and not due to an adverse modification of critical habitat. Take could occur during bridge work on Elk Creek and Hardy Creek. This effect is expected to last “days” during bridge placement. Effects of this work would be minimized by doing in-stream work during the in-stream work period which is July 1 to August 15 in the South Fork McKenzie watershed. During this time it is highly unlikely that spring Chinook salmon or bull trout would be spawning~~ during this period~~.

Because the “likely to adversely affect” determination is based on “take” and not on habitat modification, the Green Mountain project in association with past and present timber management projects in the South Fork McKenzie River would not push fish populations or listed caddisflies to a threshold where their continued existence would be jeopardized.

The fall and leave treatment actions would overlap with past fish habitat restoration and enhancement project. As stated previously, these projects are considered to have short term adverse effects but long term beneficial effects. The addition of more trees into fish habitat, in relation to past projects, would have a beneficial cumulative effect on fish and aquatic insects.

3.5 Wildlife

3.5.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for snags and down wood includes the project activity units and the South Fork McKenzie River 5th field Watershed. The geographic scale used to assess direct, indirect and cumulative effects for early seral wildlife habitat, sensitive species, migratory land birds, and terrestrial MIS species was the project activity units and the project area. For threatened northern spotted owls, a 0.5 and 1.2 mile radius buffer around all pair activity centers for the spotted owl within the project area was used to determine available amounts of suitable and dispersal habitat. The geographic scale used to assess direct, indirect and cumulative effects for elk habitat includes the project activity units and ten Elk Emphasis Areas which management activities would occur in. These emphasis areas were used for the scope of analysis because of established ratings for elk habitat as described in the Willamette National Forest Plan Standards and Guidelines. Only the northernmost Elk Emphasis Area, Cougar, includes some private land. Cumulative effects for each species or habitat type discussed below considered the past, present and reasonably foreseeable actions shown in Appendix F. Projects that modified forested habitats continue to have ongoing effects on many wildlife species, especially those dependent on late-successional forests.

General Disturbance Effects

Mobile wildlife species would be temporarily displaced from the areas where logging, underburning, and other activities occur. Where habitat for the species is maintained, the animals are expected to return to the units soon after the activities cease. For example, deer may be displaced from a unit during the day when tree falling is occurring, but may return to forage in the unit at night. No wildlife species are expected to be displaced for longer than the project implementation timeframe, by temporary disturbance alone. Some species may be displaced long-term (50-100 years or more) when their habitat is removed by regeneration harvest and underburning. Retaining overstory leave trees, creating snags, and falling trees for sources of downed logs retains habitat components for some species so they can still persist in the harvest units, but at lower levels than if no treatment had occurred. For those species, the habitat is considered to be degraded rather than removed. Other species such as deer, elk, or the Western Bumble Bee may benefit from opening of the forest canopy because that would stimulate understory forage and flowering forb development.

3.5.2 Affected Environment – Early Seral Habitat

Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements, whereas other species thrive in middle age or old forests. Early seral habitat (defined here as less than 15 years old to represent grass/forb thru sapling/pole habitat) is of key importance to an estimated 165 to 198 species of wildlife in the Westside/Montane Forests of Oregon and Washington (Johnson D.H, O'Neil T.A., 2001, p. 194).

Historically, early seral habitat in the project area was created from stand-replacing fires and regeneration harvest. Changes in forest management on Federal lands in the past 30 years, including fire suppression and reduced regeneration harvest have resulted in fewer acres of early seral habitat creation. Additionally, fire suppression (removing stand and non-stand replacing fires) and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and diverse quality early seral habitat in the project area than in the past. Currently, early seral habitat within the Green Mountain project area is only partially effective (marginal) at providing quality diverse early seral habitat due to the lack of vertical and horizontal stand structure.

The proposed project is needed to balance the age class and structural diversity in the proposed project area, providing benefits to vegetation, wildlife and overall health of the forest. The presence of all age classes, from the very young forests (0-15 years) to the very old forests (250+ years) is important for ecosystem health, ensuring that habitat needs of a multitude of plants and animals, is better situated to persist in the future despite uncertainties associated with climate change. The proposed project would help restore age class diversity with thinning, gap diversity, dominant tree release and skips.

A current analysis of stand ages shows that approximately 80 acres or 0.09 percent of the land managed by the Forest Service within the Green Mountain project area is 0-15 years of age.

3.5.3 Environmental Consequences – Early Seral Habitat

Direct and Indirect Effects

Alternative 1 – No Action

With implementation of Alternative 1, the amount of diverse early seral habitat in the Green Mountain project area would continue to remain at very low levels below 0.1% of the project area. Most of the current early seral habitat is in the north end of the project area on private lands where 2014 aerial photography shows approximately 600 acres that were recently harvested. The quality of this early seral habitat is low because it lacks hardwoods, shrubs, or the naturally occurring structure of dead wood habitat components. Future natural tree mortality (insects, disease, wildfire, or blowdown) in the Green Mountain project area is not expected to be significant or likely to produce many openings in the short-term (approximately 10 years) future, resulting in no noticeable increase in early seral habitat across the landscape. An exception is the private land outside the project area which is west of the northernmost area, which has several thousand acres of recently harvested stands that currently contain low quality early seral habitat.

Alternative 2

Treatments proposed in Alternative 2 would increase early seral habitat to approximately seven percent in the project area. Swanson (2012, pg. 4) stated that at any point in time, a given landscape would be composed of 5-20 percent early seral habitat. The historic forest age-class distribution, derived from *A Landscape Plan Based on Historical Fire Regimes for a Managed Forest Ecosystem: the Augusta Creek Study* (USDA 1998), states that approximately seven percent of the Green Mountain project would historically be in young, 0-15 year old stands.

Diverse early seral habitat would be created by cutting approximately 320 acres of 1-to-3 acre gaps, and approximately 325 acres of regeneration harvest. DTR would result in additional lower quality early seral habitat due to the small 1/4 to 1/3 acre size of the openings. In total, the above treatments would increase the early seral habitat by approximately 935 acres on federal land in the Green Mountain project area (approximately 0.01 percent of the project area). These acres would be expected to provide early seral habitat for 15-20 years. Post-harvest underburning would improve shrub and forb development, and support the occurrence of more high quality early seral habitat.

Commercial thinning on approximately 2,357 acres would also increase use of the highly stocked forests and make them more suitable to a wider range of early seral-dependent wildlife species, compared to the current dense closed canopy condition. The commercial thinning would provide lower quality early seral habitat because stands would not be thinned heavily, and not enough light would reach the forest floor to create the high quality early seral habitat that many species rely on. The overall impact of the proposed actions is that dense closed canopy mid-seral forests would be thinned to a more open condition with gaps that would provide diverse early seral habitat. These more open habitat conditions associated with the thinning are expected to last approximately 15-20 years, depending on the site and final canopy cover. Some species that would benefit from increased understory vegetation include Roosevelt elk, black-tailed deer, turkey vulture, sharp-shinned hawk, Cooper’s hawk, California quail, long- and short-eared owls, Vaux’s swift, Anna’s hummingbird, rufous hummingbird, western bluebird, olive-sided flycatcher, as well as the overall avian biodiversity.

Alternative 3

The effects of Alternative 3 are similar to Alternative 2, with Alternative 3 having less acres proposed for gaps and dominant tree releases, and no shelterwood harvest. There would be less acres of diverse early seral habitat created with Alternative 3. Early seral wildlife habitat would be created in approximately 261 acres of gaps and approximately 206 acres of dominant tree releases which would increase the total acres of early seral habitat on federal lands by approximately 467 acres on federal land in the Green Mountain project area (approximately 0.005 percent of the project area). In addition 2,491 acres would be commercially thinned.

Cumulative Effects

Alternatives 2 and 3

The Green Mountain project would be the first project to include any regeneration timber harvest on Forest Service lands in the project area since the early 1990s. No complex early seral habitat has been created by wild fires in the project area in the past 50 years. A 38 acre fire burned in the 1970s; however, it was mostly an understory burn that did not produce much early seral habitat. About 261 acres of thinning projects have been implemented since 2000. The 2013-completed Cascade Thin project included approximately 10 acres of small gap treatments that created a small amount of early seral habitat. Much of the private lands in the Green Mountain project area have been cut over in the past 20 years. It is not reasonably foreseeable that other stands would be cut on private grounds at this time. The clearcuts on private lands are expected to provide low quality early seral habitat within the project area for the next 10-20 years.

3.5.4 Affected Environment – Northern Spotted Owl (Threatened)

The northern spotted owl is a federally threatened species under the Endangered Species Act (ESA) that uses forest habitat in the project area. Effects of the various proposed actions for the Green Mountain project were addressed by the Willamette Planning Province Level I Terrestrial Team (2012) and evaluated by the U. S. Fish and Wildlife Service (USFWS) in the FY2013 Biological Opinion (BO) (FWS Reference Number 1EOFW00-2012-F-0158). This BO fulfills the Forest Service's legal requirement with respect to Section 7 of ESA for the Green Mountain Project and is consistent with the June 26, 2013, order by Judge Leon in *Swanson Group Mfg. LLC et al. vs. Jewell et al.* (Case 1:10-cv-01843-RJL, Document 63). This DEIS incorporates by reference this BO, as well as the Biological Assessment and letter requesting conference conversion after the 2012 designation of Critical Habitat (USDA Forest Service 2012) (FWS reference: 01EOFW00-2013—TA-0034) that supported the consultation. The analysis of effects to spotted owls in this DEIS is consistent with regional direction provided October 22, 2013, and November 3, 2015 (Walter 2013, Peña 2015). A summary of the effects of the alternatives on the northern spotted owl is provided in this section. Consultation and coordination with USFWS was conducted for this project and, as relevant issues relating to recovery of the northern spotted owl were brought forth, the project was modified to address these.

Effects to the northern spotted owl is based on current survey information provided by the H J Andrews Spotted Owl Demographic Study Area (Forsman et al. 2011), past district wildlife survey data, and potential owl sites. Five potential spotted owl sites were considered in this analysis based on habitat suitability, habitat quantity, and the distance to the next nearest owl site. This methodology was used in absence of current district spotted owl surveys, and is based on standard methods used in the Willamette Planning Province and supported by science (Willamette Planning Province 2015. Potential sites could support breeding spotted owl pairs and management of such areas is recommended in the Recovery Plan (U.S. Fish and Wildlife Service 2011). Potential site designation is based on guidance in the Recovery Plan, decades of knowledge acquired from spotted owl surveys, and the best commercial and scientific information available. Spotted owl habitat associations and habitat requirements for reproduction were considered. Potential site centers and their nest patches were located in the best available habitat likely to facilitate spotted owl nesting by providing suitable nest trees and foraging habitat for rearing of young. .

A total of twenty-five owl sites, both known and potential, were identified and occur in vicinity of the proposed Green Mountain harvest units.

Interspecies Competition: The barred owl occurs throughout the Willamette National Forest. Competition with barred owls has been found to be an important threat to northern spotted owls (USFWS 2011). In western Oregon, both species prefer forests older than 120 years of age and the larger and more aggressive barred owls can displace spotted owls where they establish territories (Wiens 2012). Wiens (2012) has recommended retaining conifer forests older than 120 years of age as a method to reduce interspecific competition between the owl species. Where barred owls occur, he has found that spotted owl survival significantly declines as the percent of forests >120 years of age in the general home range drops below 35 percent.

Recovery Action 32 of the 2011 Revised Recovery Plan for the northern spotted owl identified a need to maintain older, more structurally complex multi-layered conifer forests containing large diameter trees, high amounts of canopy cover, and decadence components such as broken topped trees, mistletoe, large snags, and fallen trees (U.S. Fish and Wildlife Service 2011). Guidance for identifying such stands has been developed for the Willamette National Forest with review by USFWS and Bureau of Land Management (Doerr 2012). No Recovery Action 32 (RA32) habitat occurs within the proposed treatment areas, and thus none would be modified or removed for this project

Northern spotted owl habitat is classified as:

1. Suitable habitat that provides for nesting, roosting, and/or foraging, consisting of "…forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90 percent); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly. This habitat is described as nesting and roosting habitat in the revised northern spotted owl recovery plan (USFWS 2011, p. A-10)." Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. Those units for the project which were considered to be suitable spotted owl habitat provide for foraging and roosting with marginal potential for nesting due to the relatively young growth form of the upper canopy and the absence or relatively low number of legacy trees over 250 years old.
2. Dispersal-only habitat provides for protection from avian predators and at least minimal foraging opportunities during dispersal and colonization periods. Dispersal habitat consists of, at a minimum, stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS, 2011, p. A-10). It is comprised of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (dbh) with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, and to roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that would provide some roosting and foraging opportunities during the colonization phase of dispersal, but not at a scale that would support nesting pairs (Willamette National Forest 2009). While dispersal habitat is often referred to in a general sense as stands that are 40-79 years old, growing site conditions, tree spacing, elevation, stand size and landscape juxtaposition, precommercial thinning history, and stand structure, all play a role in the habitat a stand may provide at a particular age after harvest or other disturbance event.

3. Non-habitat refers to land which is capable of growing habitat, but does not currently function as either suitable or dispersal habitat.

The Green Mountain units contain a mix of forest stand age classes and were classified into non-habitat, dispersal, and suitable spotted owl habitat based on aerial photos and field reviews conducted in 2011 and 2012. Owl habitat mapping estimates there are currently approximately 43,665 acres of suitable habitat (44%), 14,850 acres of dispersal habitat (15%), and 38,084 acres of non-habitat (41%) in the Green Mountain project area (Table 31). In addition, there are 2,487 acres of private land in the upper northwest part of the Green Mountain project area. These private lands make-up 0.03 percent of the total project area and are assumed to be non-habitat for spotted owls, thus were not incorporated into the spotted owl analysis or numbers represented in Table 31 shown below.

Table 31. Green Mountain Project Area Spotted Owl Habitat Type Distribution by Acres and Percent

	Suitable Acres	Dispersal Acres	Non-Habitat Acres	[1]Total
Green Mountain Project Area	43,665 or 44%	14,850 or 15%	38,084 or 41%	96,599 (100%)

1 These acres are only a reflection of spotted owl habitat classifications within the project area and do not reflect all the acres in the project area; they do not include acres which are highly unlikely to function as spotted owl habitat such as Cougar Reservoir, large rock outcrops, or private lands.

Effects of habitat modification on individual northern spotted owl sites are assessed at three spatial scales: the home range, core area, and nest patch.

Home Range – A home range in the Oregon Cascades Province is a 1.2 mile radius circle (2,955 acres) around a known or potential spotted owl site (Thomas et al. 1990, Courtney et al 2004). It is used by northern spotted owls to obtain cover and food, and for reproduction and rearing of young. Home ranges of multiple northern spotted owl pairs may overlap with habitat shared between adjacent resident northern spotted owl pairs and dispersing northern spotted owls. These areas are important for the survival and productivity as northern spotted owls are non-migratory.

Core Area – Within the home range, the core area (500 acres) is a 0.5 mile radius circle centered on the activity center, representing the area most heavily used during the nesting season (Bingham and Noon 1997). The core area is defended by territorial northern spotted owls and generally does not overlap the core areas of other northern spotted owl pairs.

Nest Patch – Within the core area, the nest patch (70 acres) is defined as a 300 meter radius circle around the activity center. This is based on habitat use of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest. The two key elements of habitat within a nest patch are: (1) canopy closure of dominant, co-dominant, and intermediate conifer and hardwood trees and (2) the amount of down wood. Modification of habitat within this area is considered likely to affect the reproductive success of nesting northern spotted owls and is used in determination of incidental take. There are no proposed units that overlap nest patches.

The U.S. Fish and Wildlife Service (USFWS) have determined viability thresholds of 50 percent suitable habitat in the core area and 40 percent suitable habitat in the home range, respectively. Suitable habitat levels below these thresholds are thought to compromise the reproductive success of owls. Within care areas, more than half of the high quality spotted owl territories had core areas comprised of 50 to 65 percent older forest (Franklin et al. 2000). Bart (1995) calculated that spotted owl populations are stable when the average proportion of nesting, roosting, and forage habitat in the home range is 30 to 50 percent). Owls may successfully fledge young when suitable habitat drops below these percentages, but the likelihood of this decreases as suitable habitat declines.

3.5.5 Environmental Consequences – Northern Spotted Owl (Threatened)

The effects of the Green Mountain project on the northern spotted owl are described below by**:**

- Northern Spotted Owl Habitat
- Northern Spotted Owl Critical Habitat
- Known Owl Sites
- Disruption

Direct and Indirect Effects - Northern Spotted Owl Habitat

Alternative 1 – No Action

Alternative 1 would have no effect on spotted owls or their habitat. Non-habitat plantations would slowly develop into dispersal habitat within another 10-15 years as the stands thin themselves. Those stands which are currently dispersal habitat would develop into low quality foraging habitat with limited nesting opportunity within 40-50 years. The stands which are currently foraging habitat with some nesting opportunity would develop towards old growth conditions and start to become high quality owl suitable habitat fitting the Recovery Action 32 stand characteristics in approximately 50-100 years.

Alternative 2

Alternative 2 would treat a mix of age classes with various treatments types to meet the purpose and need of the Green Mountain project. Table 32 displays Alternative 2 proposed treatments by age class, treated acres, and treatment type. It is important to note that more acres were consulted on for modification and removal than actual acres proposed for these treatments as consultation included "non-treated" areas in units such as skips and untreated areas of Riparian Reserves. In some cases, the effects on owls would be lessened by these "untouched areas" although this is somewhat dependent as to where they occur on the landscape and how they connect to other habitat types.

Table 32. Age Class Acres by Treatment Type – Alternative 2

Regeneration Harvest Age Class	Acres of Regeneration Harvest by Age Class (skips not included)
15-40 years of age	135
41-80 years of age	118
81-135 years age	71
Total	**324**
Thinning, Gaps, and Dominant Tree Release Units Age Class	**Acres of Treatment Thinning, Gaps, and Dominant Tree Release by Age Class**
15-40 years of age	1951
41-80 years of age	776
81-144 years of age	276
Total	**3,003**

Table 33 below shows amount of acres proposed for treatment by spotted owl habitat type.

Table 33. Treated Acres by Spotted Owl Habitat Type

Spotted Owl Habitat Type(s)	Suitable Acres		Dispersal Acres		Non-habitat Acres	
	Alternative 2	Alternative 3	Alternative 2	Alternative 3	Alternative 2	Alternative 3
Harvest Acres	411	0	3,287	3,287	592	592

Treatments in Suitable Habitat: Alternative 2 would remove approximately 411 acres or 1 percent of suitable owl habitat in the Green Mountain project area, making the habitat unsuitable for spotted owls (Table 34). About half of these stands just over 80 years of age are currently marginally suitable owl habitat. In approximately 40 years post-harvest, these stands would develop into dispersal habitat. Retention of 25 large trees per acre would allow these stands to more rapidly develop into suitable habitat compared to what would occur in a regeneration harvest without leave tree retention. The regenerating stands would become suitable owl habitat and may achieve stand characteristics that fit the Recovery Action 32 description after 80 to 140 years, due to the retention of legacy trees that would exist in the stands at that time. This would especially be true if large snags and down wood are present.

Treatments in Dispersal Habitat: About 3,287 acres of dispersal habitat would be moderately and heavily thinned, as well as regenerated, the latter two of which would remove dispersal habitat (Table 34). Units proposed for moderate thinning would maintain an average of approximately 40 percent canopy cover and are expected to close their canopies back to pre-harvest conditions within 7-10 years. This would allow recovery of flying squirrel habitat conditions, benefitting the preybase of spotted owls. Units with heavier thinning treatments and lower average canopy retention near 30 percent would need approximately 10-15 years to reclose their canopies back to pre-harvest conditions. Dispersal habitat units with proposed regeneration harvest treatments would reach dispersal habitat conditions approximately 40 years post-harvest. Regeneration harvest treatments are on 377 acres or 11 percent of the dispersal habitat in the project area. Thinning of dispersal habitat would benefit overall forest structural development and improve long-term (>20 years) spotted owl habitat conditions. If large snags and down wood habitat conditions are enhanced post-harvest, stand structure would improve even more for spotted owls and their prey in the long-term (>20 years).

Treatments in Non-Habitat: approximately 592 acres, or approximately 2 percent, of forest stands that are currently non-habitat for spotted owls in the Green Mountain project area would be thinned (Table 34). This treatment would benefit spotted owls because forest structure would be improved over the current condition. Some of these forested stands characterized as “non-habitat” contain stand averages of trees with diameter breast heights of 11 inches, which is the lower size limit typically used to describe dispersal habitat. However, tree densities in these stands were judged to be too dense for owls to fly through, thus this habitat was determined to be non-habitat. Thinning of these stands would allow them to develop into dispersal habitat conditions faster than if they were left to develop naturally. Those stands which are currently too dense for owls to fly through and that would be thinned to leave an average 40 percent or denser canopy cover, would meet dispersal habitat conditions after thinning. This would improve this habitat in the near future and longer term. Structural enhancements such as snag and down wood placement would further benefit spotted owl habitat quality.

Alternative 2 would not preclude meeting recovery goals for spotted owls, and the landscape would still support provide suitable and dispersal spotted owl habitat post-treatment.

Table 34. Alternative 2 Spotted Owl Habitat Acres

Habitat Type	Alternative 2	Post-treatment habitat type
Suitable habitat removed	411	Non-habitat
Dispersal habitat removed	1,337	Non-habitat
Dispersal habitat downgraded	1,949	Non-habitat
Non-habitat thinned	592	Non-habitat

Alternative 3

Alternative 3 would have similar effects on forest structure and response as described in Alternative 2 for similar treatments. Alternative 3 does not include any suitable spotted owl habitat treatments, thus, the effects of this alternative on spotted owls are much less than those of Alternative 2. Table 35 below shows the amount of acres proposed for treatment by spotted owl habitat type.

Treatments in Suitable Habitat: Alternative 3 does not harvest any suitable spotted owl habitat, treating only stands under 80 years of age (Table 35). Not harvesting the currently suitable owl habitat would maintain this habitat and the structural dead wood elements for use by foraging spotted owls and their flying squirrel prey.

Treatments in Dispersal Habitat and Non-Habitat: Acres and effects of dispersal habitat treatments for Alternative 3 are the same as those for Alternative 2 described above. Acres and effects of non-habitat treatments for Alternative 3 are the same as those for Alternative 2 described above (Table 35).

Table 35. Alternative 3 Spotted Owl Habitat Acres Proposed for Treatment

Habitat Type	Alternative 3	Post-treatment habitat type
Suitable habitat removed	0	Non-habitat
Dispersal habitat removed	1,337	Non-habitat
Dispersal habitat downgraded	1,949	Non-habitat
Non-habitat thinned	592	Non-habitat

Alternative 3 would not preclude meeting recovery goals for spotted owls, and the landscape would still support provide suitable and dispersal spotted owl habitat post-treatment.

Cumulative Effects - Northern Spotted Owl Habitat

Alternative 1 – No Action

Alternative 1 would have no direct effects on spotted owl habitat, so there are no cumulative effects to be considered.

Alternative 2

Since 1990, about 1690 acres of older forests or suitable spotted owl habitat have been harvested in the Green Mountain project area (Appendix F). About 997 acres were thinning harvests, and most of that occurred in dispersal habitat for spotted owls. Other recently completed projects that removed forested habitat in the Green Mountain project area include loss of about 24 acres of dispersal habitat of large trees around meadow edges in the Chucksney Grasshopper project area in an effort to maintain these meadows.

There are no other reasonably foreseeable or ongoing projects that would remove older forest habitat in the Green Mountain project area. Considering direct, indirect, and cumulative effects, Alternative 2 may affect and is likely to adversely affect northern spotted owl habitat, but would not jeopardize the continued existence of the spotted owl.

Alternative 3

Similar to Alternative 2, considering direct, indirect, and cumulative effects, Alternative 3 may affect spotted owl habitat, but would not jeopardize the continued existence of the spotted owl.

Direct and Indirect Effects – Northern Spotted Owl Critical Habitat

The Green Mountain Project was planned and consulted on prior to the release of the revised 2012 critical habitat boundaries.

After the 2012 northern spotted owl critical habitat rule was released, the project was re-evaluated and it was determined that a portion of the project was located in 2012 Critical Habitat Unit West Cascades South, subunit WCS 4, which is approximately 29,830 acres. Conferencing was conducted on Proposed Revised Critical Habitat and effects to northern spotted owls (USDA Forest Service 2012). After the final revised Critical Habitat was determined, USFWS conferred that the Conference Opinion was the Biological Opinion for the purposes of consultation on revised Critical Habitat for the Green Mountain Project (FWS reference: 01EOFW00-2013-TA-0034). Alternatives 2 and 3 were modified to reduce acres in Critical Habitat, and regeneration harvest treatments within critical habitat were dropped, reducing overall effects. The project was also modified to ensure that the final average canopy cover post-harvest for all thinning units proposed in current suitable and dispersal habitats (within critical habitat) would remain at least 40 percent and thus meet dispersal habitat requirements. The exception are the five proposed heavy thin units (5120, 5130, 5140, 5370, and 5380) located in the 9D Cascade Special Habitat Area.

In 2012, northern spotted owl critical habitat was designated and overlaps with the 9D Cascade Special Habitat Area. While the purpose of critical habitat is to aid in the recovery of the northern spotted owl, this designation also considers broader landscape management goals that encourage landscape-level planning and vegetation management that allow historical ecological processes, such as characteristic fire regimes and natural forest succession, to occur on these landscapes throughout the range of the spotted owl. This approach has the best chance of resulting in forests that are resilient to future changes that may arise due to climate change (USFWS 2012, p. 71881).

The Green Mountain project was planned at the landscape level and historic fire patterns were analyzed. It was determined that the overall project area is currently deficient in early seral habitats, which led to a project design of moving parts of the landscape towards the historic pattern and amounts. The critical habitat rule provides for “management actions within critical habitat that would restore or encourage early seral restoration where such habitat is underrepresented at the landscape ecosystem level and where the goal is to conserve landscape and biological diversity” (USFWS 2012 p. 269).

Alternative 1 – No Action

Alternative 1 would have no direct effect on spotted owl Critical Habitat. If left unthinned, non-habitat plantations within Critical Habitat totaling about 76 acres would develop into dispersal habitat in about 20 years as the stands thin themselves with little structural diversity, compared to 10-15 years with thinning treatments in Alternatives 2 and 3. Those stands which are currently dispersal habitat would develop into low quality foraging habitat within 40-50 years. While the timeframe to develop into foraging habitat is not expected to be any different as with thinning, the stand structure would be less diverse compared to with thinning treatments. More details about these changes are described in 3.1 Forest and Stand Structure. Stands that are currently foraging habitat would continue to remain in this habitat type.

Alternative 2

The following summary of effects and discussion (Alternative 2) is specific to treatments which would occur in Northern Spotted Owl Critical Habitat Unit Cascades South, subunit WCS4. It should be noted that some of these treatment acres and effects have been discussed previously, although those discussions encompassed additional acres and areas not within designated critical habitat.

Treatments in Suitable Habitat within Critical Habitat: The project proposes to downgrade 57 acres by thinning suitable habitat. Post-thinning, these stands would continue to function as dispersal habitat since the final average canopy cover would remain above 40 percent. Downgrading 57 acres of suitable habitat to dispersal habitat *may affect, and is likely to adversely affect critical habitat*.

Treatments in Dispersal Habitat within Critical Habitat: This project proposes to thin 1,187 acres of dispersal habitat. All thinning units would maintain at least 40 percent average canopy cover after harvest across the stand which would maintain dispersal habitat conditions. Habitat would continue to function as dispersal habitat and thinning of these dense stands would accelerate the development of this dispersal habitat into suitable habitat. Therefore, thinning of these 1,187 acres of dispersal habitat *may affect, but is not likely to adversely affect critical habitat*.

Treatments in Non-Habitat within Critical Habitat: The project proposes to thin 76 acres of non-habitat in two stands. While the average diameter breast height size of these stands exceed the minimum 11 inches that is the typical definition used to describe dispersal habitat requirements, these stands were judged to be too dense for owl movement or provide dispersal habitat function. Thinning these stands would improve habitat structure for spotted owls in the longer term after approximately 10 years. Thinning treatments may accelerate the development of non-habitat conditions into dispersal and suitable habitat by thinning overstocked stands and/or providing additional structure to the stands. Because this is not currently functioning as spotted owl habitat, treatments may be beneficial, and thinning of these stands would improve habitat structure for spotted owls in the longer term after approximately 10 years. Thinning of these 76 acres of non-habitat *may affect, but is not likely to adversely affect critical habitat*, as the thinning would remove primary constituent elements of critical habitat i.e. trees.

Treatments to Known and Potential Sites within Critical Habitat: The impact of these forest proposed treatments which would downgrade dispersal or suitable habitat, on the 11 known and two potential sites in the area of the proposed units within critical habitat were analyzed (Willamette Planning Province Level 1 Terrestrial Team 2102). Additional analysis included using 30 hypothetical core areas (500-acre circles between other core areas) in order to assess the effects relative to habitat connectivity and its' ability to provide for dispersing spotted owls and movement of owls between core areas. The original Green Mountain Project proposal would have removed 71 acres of suitable owl habitat in Critical Habitat. The project proposal has since been modified, as discussed previously, in order to reduce effects to spotted owls. Alternative 2 would downgrade 57 acres from suitable to dispersal habitat within Critical Habitat (Table 36). This would reduce the amount of suitable habitat spotted owls would have in one 0.5 mile core area and within three owl pair home ranges. This could affect their ability to maintain their life functions and to provide for their reproductive capability. Additionally, these actions tend to fragment larger blocks of "continuous blocks of late-successional forest" (USFWS 2012, p.131).

Table 36. Effects on Owl Sites within Critical Habitat – Alternative 2

Owl Site	Units	Suitable habitat acres downgraded within 0.5 mile core area	0.5 mile core area suitable habitat acres/% suitable	0.5 mile core area suitable habitat acres post-harvest/% suitable	Suitable habitat acres downgraded within 1.2 mile home range radius	1.2 home range radius suitable habitat acres/% suitable	1.2 home range radius suitable habitat acres post-harvest/% suitable
1413	1830	3	352/70%	346/69%	9	1,760/60%	1,703/58%
	1840	0			14		
	1880	3			3		
	1890	0			31		
2423	1830	0	258/52%	258/52%	7	1,284/43%	1,246/42%
	1890	0			31		
0858	1830	0	200/40%	200/40%	2	1,252/42%	1,208/42%
	1840	0			14		
	1890	0			28		

Owl site 1413: Six acres of suitable habitat are proposed to be downgraded by thinning within the 0.5 mile core area.. This owl site currently has approximately 352 acres of suitable habitat within the core area which would be reduced to 346 acres. These acres in units 1830 and 1880 are not within a 300m nest patch. Both stands are approximately 144 years old and do not meet the criteria for RA32 habitat. Downgrading these six acres would still retain suitable habitat above threshold levels and maintain the functionality of the owl site for nesting and rearing young.

Owl site 1413 would also have suitable habitat within the 1.2 mile home range radius downgraded from 1,760 to 1,703 acres. Downgrading these 57 acres would still retain suitable habitat above threshold levels and maintain the functionality of this owl site for nesting and rearing young. The proposed units are located to the south and west of the current and all past historic owl site centers since the 1980s. This area has been annually surveyed by the Oregon Cooperative Wildlife Research Unit.

Owl site 2423 would have suitable habitat within the 1.2 mile home range radius downgraded from 1,284 to 1,246 acres. Downgrading these 38 acres would still retain suitable habitat above threshold levels and maintain the functionality of the owl site for nesting and rearing young.

Owl site 0858 had a nesting pair in 2015 which moved east and closer to some of the units that have suitable habitat, compared to the location the pair nested in when the Green Mountain project was initially planned. The owl site would have 44 acres of suitable habitat downgraded within the 1.2 mile home range radius, leaving 42 percent suitable owl habitat remaining. These acres are located on the very perimeter of this home range which is annually surveyed for spotted owls by the Oregon Cooperative Wildlife Research Unit. It is possible that the units to be thinned may be used as a dispersal habitat corridor. Dispersal habitat is not limiting in the surrounding landscape. Downgrading these acres would still retain suitable habitat above threshold levels and maintain the functionality of the owl site for nesting and rearing young.

Alternative 3

This alternative would not thin the suitable habitat stands within Critical Habitat discussed above under Alternative 2, and thus, effects to spotted owl sites in Critical Habitat would be limited only to thinning of dispersal habitat. Similar to Alternative 2, considering direct, indirect and cumulative effects, Alternative 3 may affect and is likely to affect spotted owl critical habitat due to gap creation in dispersal habitat within Critical Habitat, but would not adversely modify spotted owl critical habitat. Alternative 3 would not preclude meeting recovery goals for spotted owls and the landscape would still support nesting spotted owls and dispersal post-treatment.

Cumulative Effects – Northern Spotted Owl Critical Habitat

Alternative 1 – No Action

There would be no effects to Critical Habitat from Alternative 1 and thus, no cumulative effects would occur.

Alternative 2

One Critical Habitat Subunit, WCS4, is affected by the proposed Green Mountain actions. The environmental baseline includes the habitat effects of all projects in that Subunit that the Forest Service is aware of having been consulted on at the time the FY2013 Willamette Planning Province Conference Opinion. The summary of activities in WCS 4 included: a) In suitable habitat, 308 acres of Harvest Habitat Removal, 112 aces of Harvest Habitat Downgrade, 580 acres of Habitat Maintained Prescribed Burning, and removal of 430 danger trees along roadsides and campgrounds; b) in dispersal habitat, 1,305 acres of Harvest Habitat Removal, 288 acres of Harvest Habitat Maintained, and removal of 450 danger trees along road sides; and c) in non-habitat, 122 acres of Harvest Habitat Maintained and 3 acres of prescribed burning and special habitat restoration treatments.

There are ongoing effects to suitable spotted owl habitat in WCS4 from past timber sale projects that were regeneration harvested in the Green Mountain project area since 1990 (Appendix F). It is estimated that about 1,000 acres of the total acres in the Green Mountain project area were harvested in WCS 4. Given the amount of suitable habitat and functional home ranges that would remain after implementation of the Green Mountain Project, WCS4 would continue to provide demographic support to overall northern spotted owl populations and continue to provide north-south connectivity for owls between subunits in Unit 6 (West Cascades South). Because Alternative 2 would remove approximately 57 acres of suitable habitat and delay the development of foraging habitat on approximately 52 acres where gaps are created, this alternative *may affect and is likely to adversely affect 2012 spotted owl critical habitat.*

In considering direct, indirect, and cumulative effects, the Green Mountain project may affect and is likely to adversely affect northern spotted owl critical habitat, but would not adversely modify spotted owl critical habitat. There are no other reasonably foreseeable or ongoing projects that would remove older forest critical habitat in the project area. USFWS considered the effects of the Green Mountain project on interspecific competition between barred owls and spotted owls in determining that the Green Mountain project would not jeopardize the continued existence of spotted owls or adversely modify their critical habitat.

Alternative 3

Alternative 3 would thin and harvest dispersal habitat only, which is not limiting on the landscape in WCS4. Because Alternative 3 would remove approximately 45 acres of gaps and only in spotted owl dispersal habitat, the effects would be reduced compared to Alternative 2. The dispersal habitat gaps would delay the development of foraging habitat in those small areas and thus, this alternative *may affect and is likely to adversely affect 2012 spotted owl critical habitat.*

Direct and Indirect Effects - Known and Potential Owl Sites

Alternative 1 – No Action

Because Alternative 1 does not implement any future actions, there would be no effects on any known owl sites.

Alternative 2

Treatment of suitable and dispersal habitat within 300m nest patches: Alternative 2 would not harvest any suitable or dispersal habitat within a 300m nest patch. If any future spotted owl monitoring results in movement of owl nest patches near proposed units, those areas within 300m would be deleted from the units. In addition, possibly increased effects to owl sites would be analyzed and could result in additional changes to unit boundaries, as well as reinitiation of consultation with the U.S. Fish and Wildlife Service.

While most of the Green Mountain project area is annually surveyed as part of the HJ Andrews Owl Demography Study, and many owl sites are known, there are other areas that have not been surveyed in the past or have very outdated survey data due to the time and expense of conducting these. In unsurveyed areas, two potential sites were identified based on the presence of suitable habitat and sufficient distance from known sites that there was a likelihood of additional nesting territories.

Treatment of suitable habitat within the Core Area and Provincial Home Range: Alternative 2 is expected to cause harm and *may likely adversely affect* (LAA) two potential sites, 215 and 351, due to downgrading and removing suitable habitat within their core areas. Both potential sites currently already have less than the 50 percent suitable habitat “viability threshold” in their core areas, and post treatment they would drop further below the “viability threshold” (Table 37).

Potential Site 215 contains 47 percent suitable habitat in the core area and 43 percent suitable habitat in the provincial home range. The core area is currently below the viability threshold of 50 percent suitable and removing 133 acres of suitable habitat in the area (core area) would reduce it to 21 percent. This action is expected to result in harm to potential owls at this site.

Potential site 351 currently contains 29 percent suitable habitat in the core area and 35 percent suitable habitat in the provincial home range. This is a marginal owl site due to the limited suitable habitat. The potential site is currently below the viability threshold of 50 percent and 40 percent suitable habitat in the core area and provincial home range, respectively (Table 37 and Table 38). Alternative 2 proposes to remove 30 acres of suitable habitat by timber harvest, reducing the core area to 23 percent suitable habitat. It would also remove an additional 54 acres of suitable habitat within the home range. This would reduce the suitable habitat in the provincial home range to 33 percent. This action is expected to result in harm to this potential owl site core area habitat, but no harm within the home range habitat (Table 38).

Take was obtained from the U.S. Fish and Wildlife Service for the two potential owl sites discussed above and shown in Table 37 (Willamette Planning Province 2012).

Table 37. Treatments in Suitable Habitat in the Core Area (CA) - Alternative 2

Potential Site	LUA[1] of NSO site	Activity	Current Acres of Suitable Habitat in CA	% Suitable Habitat in CA	Treat-ment in Suitable Acres/ Trees	Function-ality change	Acres Suitable Habitat after treatment	CA % Suitable after Treat-ment	Effect due to Habitat Modifi-cation	Harm (y/n)
215	Matrix	Harvest Habitat Remove	238	47 percent	133	Habitat Removed	105	21 percent	LAA	Yes
351	Matrix	Harvest Habitat Remove	144	29 percent	30	Habitat Removed	114	23 percent	LAA	Yes

Table 38. Proposed Activities in Suitable Habitat in the Provincial Home Range (HR) of Known and Potential Owl Sites (USFWS 2012b) – Alternative 2

Known Site	Potential Site	Activity	Current Acres of Suitable Habitat	Current percent Suitable in HR	Treat-ment in Suitable Acres/ Trees	Function-ality change	Acres Suitable Habitat after treat-ment	percent HR Suitable after Treat-ment	Effect due to Habitat Modifi-cation	Harm (y/n)
1416		Harvest Habitat Downgrade	1129	39 percent	35	Suitable downgraded to dispersal	1094	38 percent	LAA	No
	351	Harvest Habitat Remove	1020	35 percent	54	Habitat removed	966	33 percent	LAA	Yes

Treatment of suitable habitat within the Provincial Home Range: Owl site 1416: Alternative 2 proposes to downgrade 33 acres of marginally suitable habitat in a 140-year old stand with little structural diversity in the core area. The unit was evaluated by the district biologist with respect to Recovery Action 10 and would be designed as a diversity thinning treatment that would leave 40% canopy post-treatment with snag and downed wood creation. While the harvest treatment would reduce the amount of suitable owl habitat for about 20 years, in the longer term it is expected to benefit the future development of suitable habitat by increasing tree canopy development and structure. Because only 6 acres of marginal habitat are treated on the edge of the home range, this action is not expected to result in harm to the owls at this site.

Recovery Action 10: This recovery action from the Revised 2011 Northern Spotted Owl Recovery Plan states, "Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population." Alternative 2 would remove approximately 11 acres of forest greater than 120 years of age within unit 5480. About nine acres are suitable spotted owl habitat and approximately two acres are on the southern edge of the unit and are non-habitat based on an existing canopy cover of less than 40 percent which is the threshold for dispersal habitat. These nine acres of suitable habitat fall within the home range radius of one known activity center (1990 nesting pair) and two potential sites. This minor loss in older forest would have an insignificant effect on spotted owl survival (Wiens 2012: Figure 3.2). The overall effect on spotted owls is thought to be minor because nine acres is only approximately 0.014 percent of the older forest over 120 years of age within the Green Mountain project area. This habitat does not fit the description of RA32 habitat or high quality nesting, roosting, and foraging.

Alternative 3

Because Alternative 3 does not harvest suitable spotted owl habitat, there would be no changes to suitable habitat acres within any core areas or provincial home ranges. Alternative 3 would thin and shelterwood harvest dispersal and non-habitat for spotted owls. Dispersal habitat is distributed sufficiently across the landscape.

Treatment of suitable and dispersal habitat within 300m nest patches: Alternative 3 would not harvest any suitable or dispersal habitat within a 300m nest patch. If any future spotted owl monitoring results in movement of owl nest patches near proposed units, those areas within 300m would be deleted from the units. In addition, possibly increased effects to owl sites would be analyzed and could result in additional changes to unit boundaries, as well as reinitiation of consultation with the U.S. Fish and Wildlife Service.

Cumulative Effects – Known and Potential Owl Sites

Alternative 1 – No Action

There would be no effects to known and potential owl sites from Alternative 1 and thus, no cumulative effects would occur.

Alternative 2

Past projects that have affected known and potential owl sites in the Green Mountain project area include about 6,048 acres of harvest since 1990, of which 1,690 acres were regeneration harvests and 3,361 acres of pre-commercial thinning. Only approximately 261 acres of harvest have occurred since 2000, none of which was regeneration harvest (Appendix F). These past timber sale projects have affected spotted owl distribution, habitat quantity and quality in the Green Mountain project area in the past. There are no other reasonably foreseeable or ongoing projects that would remove older forest habitat in the project area. In considering direct, indirect, and cumulative effects, the Green Mountain project may affect and is likely to adversely affect northern spotted owls, but would not jeopardize the continued existence of the spotted owl.

Alternative 3

The cumulative effects of Alternative 3 on known and potential owl sites in the Green Mountain project area are reduced compared to Alternative 2, because Alternative 3 would not harvest any suitable spotted owl habitat.

Direct and Indirect Effects - Disruption

Alternative 1 – No Action

There would be no effects to spotted owls from disruption from Alternative 1, because no activities would occur.

Alternative 2

When logistically feasible, proposed activities are modified to avoid disrupting spotted owls. Activities may be moved beyond the disruption distance of known nest sites or potential nest patches, conducted outside the disruption period or implemented during years when survey protocol determines that nest sites are unoccupied (USFWS 2012b).

The Green Mountain project may use a Type 1 helicopter to log some units during the early nesting season due to scheduling difficulties for helicopters and economics. Because some of these units are located near known or historic owl sites, this potential use of helicopters was consulted on (USFWS 2012). A summary of the USFWS consultation is shown in Table 39 which displays helicopter units, acres to be helicopter yarded, and owl sites that may be affected by noise disturbance during the nesting season. Acres shown are those proposed for helicopter yarding and not the total unit acres. Two owl sites are outside 440 yards, and use of a Type 1 helicopter during the critical nesting season *is not likely to adversely affect* (NLAA) these owl pairs if they are nesting due to noise disturbance. One additional owl site 2434 is located within 440 yards, however a nesting pair has not been located since 1992 and thus, it is unlikely that the site would be occupied with nesting owls. All three sites evaluated are annually surveyed by the Oregon Cooperative Wildlife Research Unit. For the entire Green Mountain project, effects of noise disturbance from using helicopters have been reduced since the consultation because field assessments resulted in less need to use helicopters.

Take was obtained from the U.S. Fish and Wildlife Service for disturbance to two predicted owl sites for up to two operational seasons, however this take for the predicted sites is no longer needed because helicopters in those areas are not needed Willamette Planning Province 2012). A total of xx units were consulted on for disturbance effects to spotted owls (Willamette Planning Province 2012), however only the units displayed in Table 39 below are helicopter units that may operate during nesting season and could disturb nesting spotted owls.

Table 39. Summary of USFWS Consultation for Helicopter Use Near Owl Nest Sites

Unit #	Acres that would be helicopter yarded	***Likely to Adversely Affect*** **(LAA) Owl Site**	***Not Likely to Adversely Affect*** **(NLAA) Owl Site**
390	15	None	2434
1290	10	None	None
1540	7	None	0863
1830	9	None	1413
1980	46	None	None
5160	35	None	None

The Green Mountain Design Features (Chapter 2) display all seasonal restrictions for spotted owls during the critical nesting season for additional areas near known activity centers, as well as unsurveyed areas near potential owl sites. Annual project monitoring reports would track the actual effects and report these back to the U.S. Fish and Wildlife Service. Ground-based operations as well as post-harvest understory burning seasonal restrictions within disruption distances would be followed.

Alternative 3

Alternative 3 would have reduced effects of disturbance to spotted owls compared with Alternative 2. Unit 1830 is not included in Alternative 3, and thus there would be no disturbance effects to owl site 1413 if the unit is harvested during the nesting season.

Cumulative Effects - Disruption

Alternative 1

There would be no cumulative effects to spotted owls from disruption from Alternative 1, because no activities would occur.

Alternative 2

Because most of the spotted owl pairs in the Green Mountain project area have been annually monitored since the beginning of the owl demography study in 1989, and the spotted owl has been a federally listed species since 1990 with protection, there has been little disruption during the critical breeding season from March 1-July 15 to nesting spotted owl pairs since that time. Some activities of limited duration, as well as other maintenance activities have been allowed to occur in unsurveyed habitat because it is judged that their effects would be very limited. There are no other reasonably foreseeable or ongoing projects that would disrupt nesting spotted owls, because these activities continue to be seasonally restricted where needed.

Alternative 3

Similar to Alternative 2, considering direct, indirect, and cumulative effects, Alternative 3 may affect and is likely to adversely affect owls, but would not jeopardize the continued existence of the spotted owl. Adverse effects from helicopter noise are expected but limited to three owl sites. Both Alternative 2 and 3 would not preclude meeting recovery goals for spotted owls and the landscape would still support owl dispersal post-treatment.

3.5.6. Affected Environment – Proposed Threatened and Forest Service Sensitive Wildlife Species

Sensitive species are species that are not federally listed under the Endangered Species Act, but that are designated by the Forest Service and given special consideration in project analysis due to viability concerns. The goal of the Forest Service is to manage for these species so that they will not become federally threatened or endangered. Effects of the alternatives on Forest Service sensitive species are considered in a project Wildlife Biological Evaluation (BE). This environmental impact statement incorporates by reference the analysis in the BE and provides a summary of the effects in Table 40 as shown below. Seven sensitive species have habitat or potential suitable habitat in the project area and were analyzed in detail in the project BE. One of these species, the Crater Lake tightcoil, is on both the “Sensitive” species list and the “Survey and Manage” species list; therefore discussions of effects on this species will be limited to the table below and the Survey and Manage species discussion section.

American Peregrine Falcon

Preferred nesting sites for peregrines are sheer cliffs 75 feet or more in height having horizontal ledges or small caves. Foraging is associated with a variety of open and forested habitats, however it is most closely associated with riparian settings. Numerous potential nest sites and occupied territories occur on the Willamette National Forest.

Fisher

It is unlikely that Pacific fishers occur in the project area. The analysis includes them and thus assumes their presence, or potential for reintroduction or establishment in the future. While there have been three Pacific Fisher sightings on the McKenzie River Ranger District that appear to be valid (Forest Service NRIS database), none of these have been verified with a photo or DNA. The last verified records of fishers on the Willamette National Forest were in the 1940s with the exception of a 2014 detection at the very south end of the Forest. This individual fisher may only be from a dispersing male from the recent fisher reintroduction at Crater Lake.

Townsend's Big-Eared and Fringed Myotis Bats

These two bat species are known to roost in tree and snag cavities and under loose bark (Lacki et al. 2007). On the west side of the Cascades, snags are thought to be the main roosting habitat for fringed myotis and a minor roosting component for Townsend's big-eared bats (Ormsbee personal communication). No tree/snag roost sites have been documented by the Forest Service in the project area or on the Forest, but such sites are very difficult to detect.

Johnson's Hairstreak Butterfly

Peak conditions for the Johnson's hairstreak butterfly exist in old-growth and late successional forests. Younger forests that contain dwarf mistletoe may also have the potential to support populations. No dwarf mistletoe was seen during field reviews of the proposed Green Mountain units in 2011 and 2012. Currently there are about 58,935 acres of potential habitat for the butterfly species in the Green Mountain project area (or 60 percent), and 404,500 acres of potential habitat on the Forest (22.5 percent of total forest acres).

Cascade Axetail Slug

The Cascade axetail slug (*Carinacauda stormi*) is a recently described genus and species that is endemic to the northern westside of the Oregon Cascade Range (Leonard et al. 2011). It occurs within a restricted range that includes portions of the Mt Hood National Forest, Salem BLM, and the Willamette National Forest (Burke 2013, Young and Doerr 2011). The slug is associated with needle litter duff in Douglas-fir/western hemlock forests with a vine maple understory, which is a wide-spread habitat type on the Forest. The slugs have been found in forests ranging in age from about 30 years to old-growth (Young et al. 2010). Although it has a regionally restricted range, it appears to be relatively common within its range on the Willamette National Forest (Doerr and Young 2009, Young et al. 2010). Only a very small percent of the slug habitat, on the Forest and within the Green Mountain project area, has been surveyed to date. Regardless of this fact, the species has been detected at 394 sites on the Forest. This detection rate indicates that there are thousands of sites on the Forest where this species occurs. Two sites have been found in the Green Mountain project area; one within a proposed unit and one outside a unit. These were found in 2003 while strategic surveys were being conducted. The one known location within a harvest unit would be protected with a 180-foot no harvest and no-burn buffer.

3.5.7 Environmental Consequences – Proposed Threatened and Forest Service Sensitive Wildlife Species

Direct and Indirect Effects - All Proposed Threatened and Forest Service Sensitive Wildlife

Alternative 1 – No Action

Alternative 1 would have no direct or indirect impacts on any sensitive or proposed threatened species. Stands under 40 years old would develop diverse structure more gradually compared to thinning them now. Snag and down wood development would occur naturally over time, primarily within the next 20-40 years as the stands thin themselves, benefitting habitat for the Fringed Myotis and Townsend’s Big-eared bat. Stands between 40-80 years old would continue to grow larger tree diameters. As these stands continue to thin themselves out, the small openings would begin to show more understory forbs, shrubs, and second layer of conifers, moving these stands towards late-successional habitat which would benefit fishers and bats. The older stands in the Green Mountain area would continue to develop towards old-growth, which should improve future habitat for Johnson’s hairstreak**,** fringed myotis, and Townsend’s big-eared bats. Potential habitat for the Pacific fisher would also improve over time in these stands.

Direct and Indirect Effects – American Peregrine Falcon

There would be no measurable effect impact on this species.

Alternative 2 and 3

Logging would result in slightly different prey and availability of prey in and around the units, but the overall prey base for peregrine falcons is not expected to decline. With the implementation of seasonal restrictions as recommended in the BE, there would be no impact to peregrine falcons from either Alternative 2 or 3. The proposed logging would occur outside a peregrine falcon primary zone. Noise disturbance will be seasonally restricted for units within a secondary zone.

Cumulative Effects – American Peregrine Falcon

Other past and ongoing projects (Appendix F) have altered forest structure and composition in the Green Mountain project area, which has altered the species composition and availability of peregrine prey. The cumulative effects of these projects, combined with the Green Mountain project, would still provide for the foraging needs of peregrine falcons.

Direct and Indirect Effects – Fisher

Alternative 2 and 3

Alternative 2 and 3 would retain sufficient habitat to provide for fishers should they reestablish in the area in the future.

Alternative 2 may adversely impact potential fisher habitat due to older forest habitat modification, but would not contribute towards a trend toward federal listing. Thinning of the younger stands with subsequent down wood creation in Alternatives 2 and 3 may improve down wood habitat conditions and may thus provide a minor benefit to Fishers. In addition, the proposed year-round road closure as well as road storage and decommissioning would benefit fisher habitat quality. Alternative 3 would not impact any stands over 80 years of age, and thus would be unlikely to have an impact on potential fisher habitat.

Because only one fisher location is currently known on the Willamette National Forest, and it is so unlikely that this species would occur in the Green Mountain project area, this project is judged to pose a No Effect to Fisher. Conferencing of Alternative 2 is only required if the action is likely to jeopardize the species. However, if the Pacific fisher is listed, the Forest Service would need to consult with the U.S. Fish and Wildlife Service on the effects of the Green Mountain Project on this species. There may be long-term benefits to habitat due to year-round road closures and possible large down wood enhancement. The management recommendation to leave and/or create large down wood may ensure that habitat requirements of this species is met.

Cumulative Effects – Fisher

Alternative 2 and 3

Past timber sale activities in the Green Mountain project area have modified suitable habitat for fisher, however it is unknown if this has affected fisher because their presence in the project area has not been documented. There are no other reasonably foreseeable actions in the Green Mountain project area that would affect potential Pacific Fisher habitat and thus, no cumulative effects are expected to occur.

Direct and Indirect Effects – Townsend's Big Eared and Fringed Myotis Bats

Alternatives 2 and 3

Alternatives 2 and 3 would create 932 and 473 acres, respectively, of open forested habitat with some larger trees and snags. Under Alternatives 2 and 3, an additional 3,003 and 2,987 acres would be thinned. The site-specific effect of this change on bat foraging habitat is uncertain and could range from adverse to beneficial. The project Biological Evaluation found that Alternative 2 would degrade about 0.8 percent of the estimated bat tree roosting habitat in the Green Mountain project area and 0.003 percent of the total habitat on the Willamette National Forest. The magnitude of the effects on foraging habitat at the landscape and forest level scales are insignificant because the action alternatives affect about 3 percent, of the Green Mountain project area, and less than 0.2 percent of the Willamette National Forest. Alternative 3 would not remove any forested habitat older than 80 years of age, but would remove some potential haul route hazard trees over 80 years of age that could provide roosting habitat opportunities for bats.

Cumulative Effects - Townsend's Big Eared and Fringed Myotis Bats

The 2013 completed Road 19 Salvage Project cut approximately120 roadside danger trees which may have led to the loss of suitable bat roosting opportunities. In addition, there was some large tree mortality associated with the recently completed Chucksney Grasshopper and Murphy Meadow Restoration projects (Appendix F). There are no other reasonably foreseeable activities in the Green Mountain project area that would remove older forest habitat. Because viability would be maintained at the watershed level, the proposed actions are not expected to affect viability at the larger Forest scale. Alternatives 2 and 3 may adversely impact individuals, but would not likely result in a loss of viability in the project area, nor cause a trend toward federal listing.

Direct and Indirect Effects – Johnson's Hairstreak Butterfly

Alternative 2

If Johnson's Hairstreak is present in the treatment units, they are most likely to inhabit the 447 acres of stands over 80 years that are being planned for harvest with Alternative 2. Alternative 2 would degrade 0.7 percent of the estimated potential Johnson's hairstreak butterfly habitat in the Green Mountain project area, and 0.1 percent of the total habitat on the Willamette National Forest. Dwarf mistletoe on western hemlock, which is a host for the larval stage of Johnson's hairstreak, has not been identified in the proposed older forest harvest units, thus these stands are currently considered marginal for the butterfly species.

Alternative 3

Alternative 3 would not impact Johnson's hairstreak habitat because all stands to be harvested would be under 80 years of age and thus the impacts would be immeasurable because the chances of these younger stands having any dwarf mistletoe are very low. Some individual trees containing dwarf mistletoe may be felled if they are hazard trees along the haul route.

Cumulative Effects - Johnson's Hairstreak Butterfly

The other reasonably foreseeable harvest activity in the watershed is the Road 19 Hazard Tree Removal Project which would remove some old-growth trees that have become road safety hazards. Because the majority of the potential habitat would be unaffected by activities, Johnson's Hairstreak viability is expected to be maintained at the 6th field watershed level and within the broader Green Mountain project area for both action alternatives, considering direct, indirect, and cumulative effects. Because viability would be maintained at the watershed level, the proposed actions are not expected to affect viability at the larger Forest scale. Alternatives 2 and 3 may adversely impact individuals, but would not likely result in a loss of viability in the project area, nor cause a trend toward federal listing.

Direct and Indirect Effects – Cascade Axetail Slug

Alternative 2 and 3

The proposed Green Mountain action alternatives would not impact any known documented sites for Cascades axetail slugs. The 931 acres of regeneration harvest and underburning under Alternative 2 would degrade habitat for Cascade Axetail slugs and may result in loss of the individuals at those sites; although one individual was found at a site that was recently burned indicating an ability to persist after low severity fires (Doerr and Young, 2009). Temporary road construction and the bridge replacement in Alternative 2 would also degrade habitat for the Cascade axetail slugs and may result in loss of the species at those sites. It is unknown if localized populations may be temporarily impacted due to ground disturbance.

Commercial thinning in Alternatives 2 and 3 may degrade habitat for Cascades axetail slugs, but is not expected to result in loss of the species at the stand level because the species occurs in a wide-range of forest age classes and thinning would retain some overhead forest canopy, leaf litter, and existing understory plant species. Because thinning could increase vine maple understory abundance, it could have potential benefits to slug habitat although this has not been studied. Impacts, if any, are expected to be minor due to the apparently wide range of habitat types this species may use and the relatively small size of this project within the larger South Fork McKenzie River Watershed and Green Mountain project area. Only a very small amount of the suitable Cascades Axetail Slug habitat on the forest and in the Green Mountain project area has been surveyed to date and the species has been detected at 394 sites on the Forest. This detection rate indicates that there are thousands of sites on the Forest where this species occurs.

Cumulative Effects – Cascade Axetail Slug

Other actions in the project area that may add, but are not expected to impact or lend towards cumulative effects on the slug species is the ongoing Road 19 Hazard Tree Removal Project. This project would fall and remove about 120 individual trees along roadsides. While impacts to the Cascades axetail slug cannot be excluded, they are expected to be very minor and cannot be measured. Some impacts could occur from ground disturbance. Because the direct, indirect, and cumulative effects of the Action Alternatives would impact only a small percentage of the Cascades axetail slugs that occur in the Green Mountain project area, Alternatives 2 and 3 may adversely impact individuals, but would not likely result in a loss of viability in the project area, nor cause a trend toward federal listing.

Table 40. Summary of Effects of Alternatives 2 and 3 Proposed Threatened and Sensitive Species

Forest Service Sensitive Wildlife Species	Effect Determination For Alts. 2 and 3*	Rationale For Determination
American Peregrine Falcon	No Impact	No activities planned in primary home range. Seasonal restrictions recommended in secondary and tertiary home ranges during breeding season. Proposed harvest treatments would be neutral to falcon foraging habitat.
Pacific Fisher	No Effect. Long-term beneficial impact	Fishers are unlikely to occur in the project area and the scale of the alternatives, which would impact between <1 percent to 8 percent of 3 hypothetical female home ranges, would not preclude them from reestablishing in the watershed, and effects to this species are unlikely to occur. In the long-term, potential Pacific Fisher habitat quality may benefit from year-round road closures, road storage and decommissioning, and possible large downwood enhancement.
Fringed Myotis (bat) and Townsend's Big-eared Bats	MAII**	Effects on foraging habitat and potential tree roosting and natal habitat is minor at the project area, watershed and Forest scale. Probablility that an occupied roost or natal site would be fallen during logging or hazard tree felling operations is low.
Johnson's Hairstreak (butterfly)	MAII**	Only a very small amount of western hemlock habitat would be affected by project activities and the Green Mountain Units currently have no identified dwarf mistletoe, which hosts larval stage.
Cascades Axetail Slug	MAII**	Survey data indicates that this endemic species is relatively abundant within its' restricted range. Proposed activities, plus other past, present, and reasonably forseeable actions, would impact only a small portion of the known and likely occupied sites in the project area, watershed and on the Forest.
Crater Lake Tightcoil	No impact	Survey data has only detected this species at a single location on the Willamette National Forest and streamside buffers would exceed the recommended 10 meters in suitable habitat. The exception is the bridge replacement project on Hardy Creek which was surveyed in 2014, and no individuals were found.

*Alternative 1 would have No Impact on any Sensitive Species.
**MAII: May Adversely Impact Individuals, but would not result in a loss of viability in the Project area, nor cause as trend toward federal listing. See project Biological Evaluation for a more detailed analysis.

3.5.8 Affected Environment – Survey and Manage Wildlife Species

The Northwest Forest Plan was amended with standards and guidelines for conducting project surveys and managing known sites for certain rare or endemic species that were associated with late successional forest habitat (Forest Service and BLM 2001). Species covered by this direction are referred to here as "Survey and Manage" species. There are four wildlife Survey and Manage species on the Willamette National Forest: Oregon Megomphix snail, red tree vole, great gray owl, and Crater Lake tightcoil snail.

With the exception of the Hardy Creek bridge replacement site, mollusk surveys were not required for the Green Mountain Project. Mollusk surveys were conducted at the Hardy Creek Bridge replacement work site in November and December 2014.

Oregon Megophix

This snail occurs at low to moderate elevations, below the zone of seasonally persistent snow pack. Megomphix snails are most often found within the mat of decaying vegetation under sword ferns and big-leaf maple trees and near rotten logs. Most occupied sites are on well-shaded slopes and terraces, and many are near streams (Management Recommendations for Terrestrial Mollusk Species: *Megomphix hemphilli*, the Oregon Megomphix, Version 2.0, Applegarth 2000). The three Oregon Megomphix sites that were found in 2001 are located in Unit 390 and would have 180-foot no-harvest and no-burn buffers. Oregon Megomphix is in S&M Category “A” in Linn County and this project is in Lane County, so surveys are not required, however the guidelines do require management of known sites as of 9/30/99. In western Oregon most Megomphix locations are between 500-1500 feet, with 2540 feet being the highest elevation at which this species has been found (Forest Service and BLM 1999). Unit 390 is at about 3000’ elevation and thus, this elevation is being used as the Megomphix habitat upper elevational level.

Red Tree Vole

Project surveys for the red tree vole were conducted in all proposed Alternative 2 stands over 80 years of age. Based on results of these surveys, units were dropped or buffers were placed around these sites according to management recommendations for this species (Forest Service and BLM 2000). Areas with red tree vole nests have been excluded from units in Alternative 2. If a nest tree was found, 100 meter intensive searches around these trees were conducted according to survey protocol guidelines (Forest Service and BLM, 2012). Project surveys were not required in stands to be thinned under 80 years of age for Survey and Manage wildlife species due to exemptions “A”, under what is commonly known as the “Pechman exemption(s).” Stands that are planned for regeneration harvest were evaluated but do not meet the minimum quadratic mean diameters that trigger the need for a survey in the mesic zone as defined in the survey protocol.

These standards and guidelines were developed, along with other habitat protection measures from the Northwest Forest Plan, to provide a reasonable assurance of persistence of certain species, such as red tree vole, which were believed to be rare and uncommon across the range of the Northwest Forest Plan at the time it was developed. For vertebrate species, like voles, this persistence objective is consistent with the goals of providing for viable and well-distributed populations under the National Forest Management Act Regulations (Forest Service and BLM 2001:3-4; Forest Service and BLM 1994:43-47).

Great Gray Owl

This species is most common in lodgepole pine forests adjacent to meadows, yet in some locations like the Willamette National Forest, shelterwood harvesting has also been found to be beneficial because it opens up closed forest canopy cover for foraging (Forest Service and Bureau of Land Management 2001). Pre-disturbance survey(s) for Great Gray Owls are not required because the proposed harvest units in Alternatives 2 and 3 do not have proximity to natural openings > 10 acres, and pre-disturbance surveys are not required in suitable nesting habitat adjacent to man-made openings at this time (pg. 14, Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004). The required habitat characteristics of suitable Great Gray Owl habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004).

NRIS, the Forest Service web-based wildlife sighting database, currently shows 24 records of Great Gray Owls in the Green Mountain project area. Great Gray Owl surveys conducted in the Green Mountain project area in 1998-2000 around clearcuts along Forest Road 1958, around Box Canyon Meadow and in the Skookum area detected 9, 3 and 5 occurrences, respectively. No nests were ever found during three years of survey effort at night and during the day. Most of the locations around the end of Forest Road 1958 were clumped and a nest was suspected. Two of these detections were pairs, and 5 were females. While much of the clearcut foraging habitat that existed at that time has now grown into dense stands that are no longer suitable for foraging, some areas of suitable foraging habitat still exist and may be used. Surveys have not been conducted since 2000. Additional Great Gray Owl locations in the Green Mountain project area include three in the Augusta Creek area, two in Elk Creek, and two in the Mink Lake Basin in the wilderness. None of the latter locations are within disturbance distance of Green Mountain Alternative 2 units.

The only larger meadow in the Green Mountain project area is at Box Canyon, and the nearest proposed harvest unit is over 700 feet away. There is a record of two sightings of Great Gray Owls at Box Canyon Meadow in 1997 and 1999. The recommended protection buffer distance from meadows over 10 acres is 300 feet, and any nest around that meadow would be adequately protected because the distance to the nearest proposed unit is over 700 feet.

Crater Lake Tightcoil Snail

This species is associated with areas within 10 meters of perennial wetlands and riparian areas (Duncan et al. 2003). Protection buffers were placed around perennial wetlands where they occur near or in the proposed harvest units. Impacts to this species are limited to the Hardy Creek Bridge replacement location because all other suitable habitat would be adequately buffered by 10 meters following the management recommendations for this species (Forest Service and BLM, 2002).

There is only one documented site of the Crater Lake tightcoil on the Willamette National Forest in the Hardy Creek drainage of the McKenzie River Ranger District, which is located within the Green Mountain project area. This site was found on October 24, 2005, and is over 0.5 miles from the nearest proposed Green Mountain unit. The proposed Hardy Creek bridge replacement is approximately3.5 miles downstream from the Crater Lake tightcoil location.

3.5.9 Environmental Consequences – Survey and Manage Species

Direct and Indirect Effects - All Survey and Manage Species

Alternative 1 – No Action

Alternative 1 would have no effect on the Oregon Megomphix snail, red tree vole, great gray owl, or Crater Lake Tightcoil snail because no project activities would occur.

Direct and Indirect Effects – Oregon Megophix

Alternative 2

Impacts to this species may occur from ground disturbance and opening of the forest canopy which reduces moisture this species needs. Alternative 2 may impact suitable Oregon Megomphix habitat at low and moderate elevations below 3000’ on approximately 2,261 acres, which is approximately 12 percent of the suitable habitat in the Green Mountain project area (approximately 21,860 acres below 3000’).

Alternative 3

The impacts of Alternative 3 on Megomphix habitat are somewhat less than Alternative 2, impacting about 2,231 acres of suitable habitat. This is about 10 percent of the suitable Megomphix snail habitat in the Green Mountain project area.

Cumulative Effects - Oregon Megomphix

While this project may impact individual Megomphix snails, it is not expected to result in any issues for population viability of this species. The NRIS database accessed on August 6, 2014 shows over 163 records of the Oregon Megomphix on the Willamette National Forest. These were detected with limited survey work over several years, and this number is likely only a very small percentage of all the Megomphix locations on the Forest. Impacts to individuals may occur, but overall population viability would not be impacted.

Direct and Indirect Effects - Red Tree Vole

Alternative 2

Alternative 2 would remove or thin 412 acres of red tree vole habitat in stands over 80 years of age, but would not affect any documented red tree vole nest areas. About 71 of these acres would be removed, and 325 acres would be thinned. Suitable spotted owl habitat can be used to estimate the amount of higher quality red tree vole habitat. There are currently approximately 43,665 acres of higher quality red tree vole habitat in the Green Mountain project area, and Alternative 2 would remove or thin approximately1 percent. Because of the number of overstory trees that are being left, the harvest units would return to conditions matching the description of suitable red tree vole habitat (Forest Service and BLM 2012) in approximately50-60 years.

About 2,915 acres of lower quality red tree vole habitat in stands under 80 years of age would also be impacted. While nests in younger stands are less likely to be present, they may still be present.

Alternative 3

Alternative 3 does not include any stands over 80 years of age and thus there would be no impacts to high quality red tree vole habitat. About 2,987 acres of lower quality red tree vole habitat in stands under 80 years of age would be impacted.

Cumulative Effects - Red Tree Vole

Alternative 2 and 3

Because Alternatives 2 and 3 adhere to the 2001 Survey and Manage direction and protect all known red tree vole sites, and, cumulatively, only a very small amount of higher quality red tree habitat would be affected, both alternatives are expected to maintain red tree vole persistence and viability within the Green Mountain project area. Since there are no impacts from Alternatives 2 and 3, there are no cumulative effects from the Green Mountain project that overlap in time or space with any other past, present or reasonably foreseeable future actions.

Direct and Indirect Effects - Great Gray Owl

Alternative 2

Alternative 2 would create approximately 644 acres of open habitat with shelterwood reserve harvest and 1-3 acre gaps, which may enhance opportunities for great gray owl foraging. On the west slope of the

Cascades, regeneration harvests initiate an early successional stage that can support small-mammal populations likely to be used by great gray owls up to approximately ten years post-harvest (Quintana-Coyer et al. 2004). The most critical time for disturbance to nesting Great Gray Owls is during egg-laying and incubation, which is generally March 15 - May 15, and thus a seasonal operating restriction is recommended for Alternative 2 units 5510, 5530, and the area below road 1958 on units 5800 and 5810. This seasonal operating restriction is centered on the area where Great Gray Owls were observed in 1998-2000, and would protect nesting birds and their young. Great Gray Owls in the western Cascades Province generally nest in trees with a diameter breast height ranging from 38-42 inches that are within 220 meters/656 feet near open, grassy areas (Quintana-Coyer et al. 2004). Based on the currently low amount of suitable foraging habitat in the area, there is a low probability that harvest of these units may affect a nest site.

Alternative 3

Alternative 3 does not propose to harvest any of the stands identified as being near historic Great Gray Owl locations which may be near nest locations. Alternative 3 would create approximately 261 acres of open habitat from 1-3 acre gaps, which may enhance opportunities for Great Gray Owl foraging.

Cumulative Effects - Great Gray Owl

The Chucksney Grasshopper Ridge Meadow Restoration Project has maintained approximately50 acres, and Murphy Meadow Restoration treated approximately48 acres to maintain open habitat in the Green Mountain project area, which is high quality foraging habitat for the Great Gray Owl (Appendix F). Cascade Thin Project also cut approximately 10 acres of gaps within two stands that were thinned. There are no other ongoing or reasonably foreseeable future projects in the Green Mountain project area that would modify Great Gray Owl habitat. Considering the effects of all past, present and reasonably foreseeable future actions on Great Gray Owls in the Green Mountain project area, there are no concerns for future persistence or population viability.

Direct and Indirect Effects - Crater Lake Tightcoil Snail

Alternatives 2 and 3

For all proposed units in both Alternatives 2 and 3, there would be no treatment within 10 meters of perennially wet areas, and there should be no impact on this mollusk. An exception to this is the proposed Hardy Creek bridge replacement on Forest Road 1980204 which would impact the riparian area.
While the proposed Hardy Creek bridge replacement on Forest Road 1980204 would impact the riparian area within 10 meters of the stream, the Crater Lake Tightcoil was not found during 2014 surveys and thus, there would not be any impacts to this species which is extremely rare. Over 300 acres of mollusk surveys have been conducted in the Green Mountain Project area with only one Crater Lake Tightcoil location found (NRIS database 2014.

Cumulative Effects - Crater Lake Tightcoil Snail

Alternative 2 and 3

The McKenzie River Ranger District has generally used a policy of buffering all suitable perennial water habitat by at least 10m which is considered adequate to maintain habitat conditions for this species which occurred in past projects. One future project that will not apply stream buffers is the Upper South Fork McKenzie River Enhancement Project which would have short-term (approximately5 years) impacts directly in the floodplain until the area is restored. The risk is judged to be very low because only one Crater Lake Tightcoil location is known on the Willamette National Forest, and this species is so rare. In the longer term (>5 years), additional habitat for the Crater Lake Tightcoil is likely to be created in future South Fork McKenzie River side channels, so the overall effects of the project would be beneficial. No impacts to the future persistence and viability of Crater Lake Tightcoil habitat are anticipated from the Green Mountain project.

3.5.10 Affected Environment – Management Indicator Species

The use of Management Indicator Species (MIS) in project planning was established by the 1982 National Forest Management Act planning regulations. Management Indicator Species are species whose response to land management activities can be used to predict the likely response of a wide range of species with similar habitat requirements. The Final Environmental Impact Statement for the 1990 Willamette National Forest Land and Resource Management Plan identified MIS and the rationale for their selection (Forest Service 1990: III-69, Table 41). A requirement is that viable populations of MIS be maintained at the Forest Level. The effects of the alternatives on northern spotted owl are addressed above in a specific section for that species. The effects of the alternatives on peregrine falcons are also addressed above in the section on Forest Sensitive Species. The project Biological Evaluation concluded that the alternatives would have no impact on bald eagles because the alternatives do not affect lakes and fish streams. The effects of the alternatives on the remaining MIS are addressed below.

Table 41. Wildlife Management Indicator Species for the Willamette National Forest

Indicator Species	Indicator Habitat	Reason Selected in 1990
cavity excavators[1]	dead and decaying trees	ecological indicator, limited habitat
elk	winter range	commonly hunted
Deer	winter range	commonly hunted
pileated woodpecker	old growth and mature conifers	ecological indicator, limited habitat
Marten	old growth and mature conifers	ecological indicator, limited habitat
northern spotted owl[2]	old growth and mature conifers	ecological indicator, limited habitat, proposed threatened species[2]
bald eagle[3]	old growth conifers near large bodies of water	federally threatened species[3]
peregrine falcon[3]	cliff nesting habitat near abundant prey	federally endangered species[3]

[1]Forest Service (1990) identified the following species in this group: red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, Lewis woodpecker, black-backed woodpecker, and northern three-toed woodpecker.

[2]Became a federally threatened species in June 26, 1990, as the Willamette NF Plan was being finalized.

[3]Bald eagles and peregrine falcons were subsequently delisted and are now Forest Service Sensitive Species.

Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Cavity excavator MIS are used as an ecological indicator for the abundance of dead and decaying trees. Pileated woodpeckers are MIS that use snags, but also prefer old and mature forests. Cavity excavator MIS species that occur or have potential habitat in the proposed Green Mountain Units are red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, and pileated woodpecker. None of these species are federally listed Endangered or Threatened Species, Forest Service Sensitive species, U. S. Fish and Wildlife Service Birds of Conservation Concern (USFWS 2008), or species that are regionally identified as having current viability concerns. Population trends for these species from breeding bird surveys from 1996─2010 indicate stable populations in Oregon for red-breasted nuthatch, hairy woodpecker, and downy wood pecker and increasing population trends for pileated woodpecker and red-breasted sapsucker (Sauer et al. 2012). A significant decline in northern flicker has been detected from 1996-2010. Northern flicker is a common resident species that is ubiquitous to most forest habitats in Oregon. They are most abundant in open forest habitat and along forest edges with available large (31 inches dbh or greater) snags (Marshall et al. 2003). Despite a recent decline in numbers, northern flickers are well above population levels that would suggest a viability concern.

A collection of information, referred to as DecAID, has been developed by Region 6 to help projects identify the levels of snags and downed logs required to meet wildlife population needs (Forest Service, 2012). At the landscape level, DecAID recommends providing dead wood at levels within the range of historic variability. The 5th field South Fork McKenzie River watershed was used to evaluate deadwood at the landscape level for this project. While the Green Mountain project area includes most of this 5th field watershed, it does not include the entire Three Sisters Wilderness, and also does not include areas below Cougar Dam.

The median historic condition for this watershed was estimated using levels of snags and downed logs found in strategic plots in unlogged stands of various ages and an estimate of the normal distribution of seral stages derived from the assumed fire return interval. Median values are the mid-point where half of the time deadwood levels are at or higher than that value and about half the time they are at or lower than the value. Studies have indicated that fire frequency and severity varied considerably in the past due to substantial variability in weather conditions, and fire severity varied from century to century (Wimberley et al., 2000). Therefore, levels of dead wood have fluctuated considerably over time and plus or minus 50 percent of the estimated median value was used to approximate the historic range of variability.

DecAID evaluates deadwood levels by wildlife habitat type. The South Fork McKenzie River watershed contains five different wildlife habitat types (Table 42). The Green Mountain project area is made up mostly of Westside Lowland Conifer-Hardwood Forest (WLCH_C), with some of the upper elevation units that are only in Alternative 2 in the Montane Mixed Conifer Forest (MMC) habitat type. Most of the MMC habitat type is in the Three Sisters Wilderness and would therefore not be modified with Alternatives 2 or 3. The other three habitat types, WODF, EMC_ECB, and PARK, do not have any activities proposed in them, and are thus not further discussed.

Table 42. Wildlife Habitat Types in the South Fork McKenzie River Watershed

Wildlife Habitat Type	Acres
Eastside (Interior) Mixed Conifer Forest (EMC_ECB)	1
Montane Mixed Conifer Forest (MMC)	69,400
Open Parkland (PARK)	5
Westside Lowland Conifer-Hardwood Forest (WLCH_C)	54,410
Westside Douglas-fir Forest (WODF)	2,262

DecAID provides information on snag and down wood in three tolerance levels, 30%, 50%, and 80%. The 30% tolerance level is typically used when considering landscapes that have exhibited extensive harvest activity. The 50% tolerance level is typically used when considering matrix land allocations and 80% is typically used when considering late-successional reserves. These considerations are general guidelines and it is the responsibility of the biologist to interpret and use information from DecAID to best fit the needs of the area being analyzed.

An analysis was conducted at the forest level for all 5th field watersheds to determine the estimated current percentages of the landscape that contains various levels of large snag (>20 inches dbh) habitat

(April 2013). Table 43 displays the results by Wildlife Habitat Type for the South Fork McKenzie River 5th field watershed and shows where we are currently outside the estimated range of natural variability for large snags. There are currently less acres in the tolerance level 80plus category compared to the estimated historic condition with a range of 10-30%. Various tolerance levels/intervals (tl) are displayed that show the proportion of the landscape in the wildlife habitat type that would contain the shown range of snag levels as shown in Table 44.

Table 43. Current Percentages of Landscape in Large Snags ($\geq$20inches dbh) in the South Fork McKenzie River 5th Field Watershed for the MMC and WLCH_OCA Wildlife Habitat Types

HUC_10	HU_10_NAME	Wildlife Habitat Type	tl0to30	tl30to50	tl50to80	tl80plus	sumac
1709000403	South Fork McKenzie River	MMC	40397 (58%)	13998 (20%)	10833 (16%)	4171 (6%)	69400
1709000403	South Fork McKenzie River	WLCH_OCA	24711 (45%)	10314 (19%)	14971 (28%)	4415 (8%)	54410
Median Historic Condition for Willamette National Forest (historic variability in parentheses)			30 (15-45)	20 (10-30)	30 (15-45)	20 (10-30)	

Those tolerance levels outside the range of historic variability are shaded.

Table 44. Large Snags/Acre at Various Tolerance Levels for the WLCH_OCA Habitat Type

	Tolerance Limit		
	30	50	80
WCHL	**LG Snags/acre**		
large tree stands	4.25	6.11	11.66
small to medium tree stands	2.1	4.41	10.6

Large down wood as well as snag densities have varied considerably from one century to the next due to wide fluctuations in fire severity. Table 45 displays an analysis of the current levels of the South Fork McKenzie River and Green Mountain project area landscape that contain various per acre levels of large logs. For example, about 19% of the landscape would be expected to contain approximately2-4 large logs per acre for the WLCH_OCA wildlife habitat type.

Table 45. Current Levels of the Landscape Containing Various Levels of Per Acre Large Logs (>20 inches dbh) in the South Fork McKenzie River 5th Field Watershed for the MMC and WLCH_OCA Wildlife Habitat Types

HUC_10	HU_10_NAME	Wildlife Habitat Type	0	0-2	2-4	4-6	6-8	Over 8
1709000403	South Fork McKenzie River	MMC	43%	24%	18%	8%	3%	3%
1709000403	South Fork McKenzie River	WLCH_OCA	32%	22%	19%	13%	6%	7%

Table 46 shows the weighted snag/acre average of all Alternative 2 Green Mountain stands being harvested in 2016. Current 2014 snags/acre by size class is based on Green Mountain stand exams which were conducted in 2010 and 2011. A canopy cover of 38 percent was used, which is the average residual for the entire project. The analysis assumed approximately15 percent of the existing snags would be cut or knocked down during harvest operations in 2016. Current snag numbers are those shown for 2014, 2016 is pre-harvest and 2017 is post-harvest. After the projected harvest timeframe in 2017, snags/acre is shown for every decade for 100 years. This analysis does not consider the impacts of future harvest activities in the Green Mountain project area that are not reasonably foreseeable. Future harvest is also likely to result in the loss of some snag habitat.

Table 46. Average Snags per Acre in Stands Proposed in Alternative 2

	Snags			
YEAR	All	0-13.9"	14-20.9"	>=21"
2014	37.2	33.5	3.0	0.6
2016	47.3	42.6	3.8	0.7
2017	39.2	35.2	3.3	0.7
2026	63.2	58.5	3.9	0.8
2036	76.8	70.7	5.0	1.0
2046	85.3	77.6	6.1	1.5
2056	89.1	79.8	6.8	2.3
2066	91.2	80.5	7.2	3.3
2076	91.1	79.1	7.4	4.4
2086	89.8	76.8	7.4	5.4
2096	86.2	72.4	7.1	6.4
2106	81.9	67.6	6.9	7.2
2116	77.9	63.2	6.6	7.9

Snags in Westside Lowland Conifer-Hardwood Forest Habitat Type

Most of the proposed Green Mountain Project activities are in Westside Lowland Conifer-Hardwood Forest habitat of the Western Oregon Cascades (WLCH_OCA) which occurs on 54,410 acres in the South Fork McKenzie River watershed (Table 45).

The snag analysis suggests that, for WLCH_OCA habitat, snags are below historic levels in the South Fork McKenzie River watershed for the eight percent of the watershed that historically contained high numbers of large snags/acre (Table 46). The median reference condition for total snags 20 inches dbh (diameter breast high) or larger is about 12/acre on approximately 20 percent of the watershed, compared to the current estimated landscape having these higher snag densities on approximately six percent of the watershed. The median reference condition for smaller and medium snags under 20 inches dbh or larger is approximately11/acre on that same six percent of the landscape. Currently, within the South Fork McKenzie River watershed, approximately58 percent of the WLCH_OCA habitat is estimated to have low levels of large snags (4/acre) compared to an estimate of 30 percent for the median historic condition. Within the Green Mountain stands being harvested, stand exam data shows current levels of snags over 20 inches dbh to be at 0.6 /acre. The current lower density of snags and greater percentage of areas lacking higher levels of snags compared to historic conditions is mainly due to past clearcut harvesting that removed existing snags as well as the trees that could provide future snags. Fire suppression activities have also helped reduce deadwood abundance in the watershed.

Snags in Montane Mixed Conifer Forest Habitat Type

About 69,400 acres of the South Fork McKenzie River 5th field watershed have the MMC wildlife habitat type (Table 45). The seven higher elevation units proposed in Alternative 2 are in this habitat type, which are units 5480, 5510, 5530, 5770, 5780, 5800, and 5810 which are also considered to be the higher quality marten habitat. None of these units are part of Alternative 3.

Logs in Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest Habitat Types

Current levels of large down logs within these forest types within proposed Green Mountain stands are within historic levels. Field surveys of the Green Mountain proposed units during 2011 and 2012 showed approximately38 percent of all proposed units with >6 down logs over 14 inches diameter/acre, 58 percent had moderate levels of approximately3-6/ large logs acre, and approximately4 percent had under 3 large logs/acre. Many of the plantations showed relatively high levels of large down wood that was left from the original harvest, with some logs of quite large diameters over 40 inches, which will last many more decades.

Willamette National Forest Plan (LRMP) Standards and Guidelines for Regeneration Harvest

The Willamette LRMP specifies "Prescriptions should be developed prior to timber harvest to identify amount and distribution of CWD left after harvest and fuels treatment. Management practices to recruit CWD normally pertain only to regeneration harvest and occasionally commercial thinning in stands of sufficient size if needed based on wildlife habitat evaluation. The range of linear feet/acre of downed logs by plant association is: PSME/TSME (40-135 feet), TSHE/ABAM (105-320 feet), and ABGR (60-200). The prescribed range is based on site-specific considerations such as proximity to marten and spotted owl habitat and future recruitment on site. Individual pieces contributing to CWD >16 inches at the small end and >10' long (75% of the total must be >20' long). In stands without the potential to have CWD of this size, the size of the CWD is based on the size of mature and dominant trees on that site. Further, at least 50% of the CWD meeting the requirements should be in decay class 1, and the remainder in decay classes 2 and 3. All decay class 4 and 5 logs should be left. At least 1 standing tree should be left as a potential source of CWD. If these trees are recruited for downed wood at a specified time after harvest, the trees contribute to the required linear feet of downed logs." (Amendment #6-7/13/91).

Northwest Forest Plan Standards and Guidelines for Coarse Woody Debris in Matrix Management (C-40)

The Northwest Forest Plan specifies that for regeneration harvests, 240 linear feet of logs per acre greater than or equal to 20 inches in diameter would be left. Logs less than 20 feet in length cannot be counted towards this total, and only decay classes 1 and 2 would be counted. Down logs should reflect the species mix of the original stand. In areas of partial harvest, the same basic guidelines should be applied, but they should be modified to reflect the timing of stand development cycles where partial harvesting is practiced

Elk and Deer

Elk and deer are Forest MIS, not because of viability concerns, but because they are important big game hunting species in Oregon. The project area is in the state-designated McKenzie Wildlife Management Unit (WMU). Since the beginning of the Willamette Forest Plan in 1990, deer numbers and hunter success have fallen by more than 50 percent and elk numbers have declined substantially below Oregon Wildlife Population Management Objectives (Forest Service 2011) in that WMU. Reduced forage quality and quantity due to the reduction in clearcut logging on the National Forest are important factors in this decline.

Under the 1990 Forest Plan, big game habitat objectives were established for specific Big Game Emphasis areas (BGEAs). The Green Mountain project area includes ten designated emphasis areas: Cougar, Green Ridge, Hardy, Starr, Rebel, Upper Augusta, Cascade, South Fork-Mink, Roaring River and Elk (Figure 26). Rebel, Cascade, South Fork-Mink and the Elk emphasis areas have high quality ratings, and lie mostly within the Three Sisters Wilderness. Five of the other areas are rated as moderate: Green Ridge, Hardy, Starr, Upper Augusta, and Roaring River. The Cougar emphasis area is managed for low elk habitat quality. All of these areas are managed for elk habitat under guidance from the Willamette Forest Plan Standards and guidelines (FW-137) with the assumption that providing high quality elk habitat would adequately address the needs for black-tailed deer.

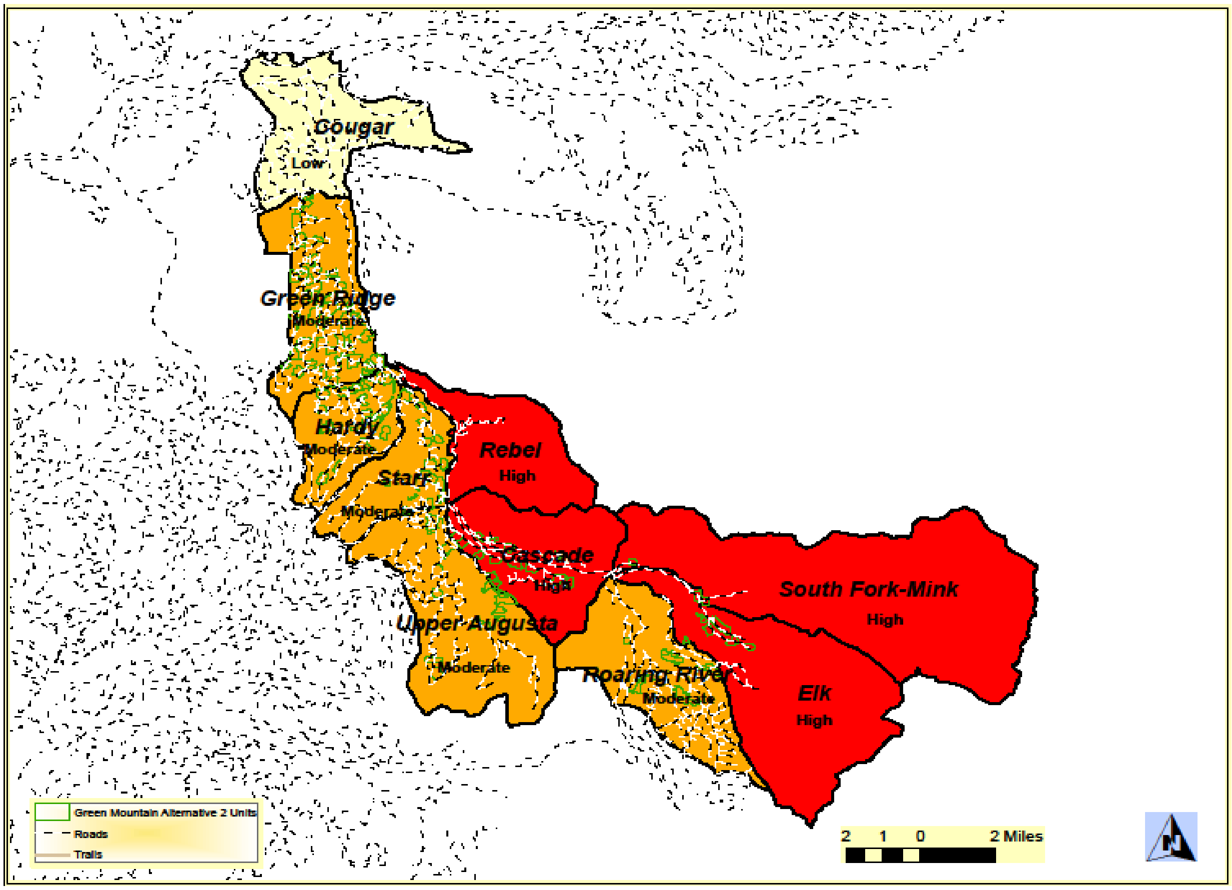


Figure 26. Green Mountain Project Area Elk Emphasis Areas

Elk Modeling for Green Mountain Project Area

A Model to Evaluate Elk Habitat in Western Oregon (Wisdom 1986) has been the tool used to evaluate elk habitat on the Willamette National Forest since 1990. Regionally, the opinion among elk biologists in Oregon and Washington is that Forest Service and Bureau of Land Management elk management guidelines developed during the past few decades, such as those within the Willamette Forest Plan, are based on science that is outdated (Wisdom et al. 2007). Over the years, issues have surfaced with the use of this model, resulting in the development of a more recent modeling tool that incorporates the results of studies on elk nutrition. A drawback of the forage analysis in the Wisdom model is that forage is evaluated based on the average value of defined forage areas and does not consider the amount of forage provided. Areas that provide meaningful forage are not considered in the forage effectiveness calculations. The condition of the Green Mountain project area for elk was reviewed using the Wisdom model to establish a baseline, as well as the newly validated Westside Elk Model (Rowland et al. 2013) which consists of two components: elk nutrition and elk habitat use.

Marten

Marten are members of the weasel family that prefer mature and old conifer-dominated forest habitat and use cavities in snags and logs for denning, resting, and natal sites. Although the Willamette Forest Plan established 9c Marten Habitat Areas at strategic locations across the entire forest (Forest Service 1990), recent information suggests that marten primarily only occur in montane conifer forests above about 4000' elevation on the Forest. An ongoing carnivore detection study in the Mt Jefferson, Mt. Washington, and Three Sisters Wilderness Areas on the Willamette and Deschutes National Forests found all sites sampled above that elevation to be occupied by marten (Hiller and McFadden-Hiller 2013). Most of the Green Mountain Project Units are in Westside Lowland Conifer-Hardwood Forest habitat at 3500-4000' elevation and are thought to be marginal marten habitat due to forest type and elevation. There are however some Alternative 2 units at higher elevations within montane conifer forests which may be more likely to be inhabited by marten (units 5480, 5510, 5530, 5770, 5780, 5800, and 5810). None of these units are part of Alternative 3.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U. S.C. 703-704). The U.S. Fish and Wildlife Service is the lead federal agency for managing and conserving migratory birds in the United States. However, under Executive Order (EO) 13186, all federal agencies are charged with the conservation and protection of migratory birds. A Memorandum of Understanding (MOU 2008) between the Forest Service and U.S. Fish and Wildlife Service requires, during NEPA planning, that the FS, to the extent practical, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the FS to consider approaches, to the extent practical, for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled some information to assist biologists in disclosing effects to avian species during NEPA planning (Forest Service and Bureau of Land Management 2013). Effects to FS sensitive birds, federally ESA listed birds, and birds that are Management Indicator Species have been addressed above. Four additional migratory bird species that have been identified by USFWS as Species of Conservation Concern in the Northern Pacific Forest (USFWS 2008) and that have habitat in the proposed treatment units are addressed in this section. These four species are northern goshawk, Rufous hummingbird, olive-sided flycatcher, and purple finch.

An emerging concern for migratory birds in the Pacific Northwest is declining early-successional forest habitat (Swanson et al. 2010). Early seral conifer habitat is important habitat for many migratory bird species, including three of the above Species of Conservation Concern (Altman and Hagar 2007). In particular, there is a lack of complex early seral habitat, which is early successional forests with abundant and diverse shrub understory composition, high abundance of large diameter snags and downed logs, and substantial green tree retention. While private logging lands may create early seral habitat, large diameter snags, downed logs and live leave trees are rarely retained in any quantity, and shrub and forb understory species may be suppressed by herbicide treatments.

3.5.11 Environmental Consequences – Management Indicator Species

Direct and Indirect Effects - Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Alternative 1 – No Action

Alternative 1 would have no impact on any cavity excavator MIS or pileated woodpeckers and would not affect current levels of snags and dead wood. The forest would continue to develop towards old-growth and this should result in a future increase in large snags and large downed logs in those stands and improve future habitat for woodpeckers that prefer old forest habitat, such as the pileated woodpecker. There would be no increase in habitat for species, such as northern flicker, that prefer forest edges and open forest habitat with large snags. There would be no additional wildlife tree and large down wood creation as shown in Table c.

Alternatives 2 and 3

Snag abundance may initially decline on 4,405 and 3,961 acres of forest in Alternatives 2 and 3, respectively. It should be noted that these acres exceed the total harvested acres shown in Table 2.5 because the latter exclude skips, gaps and untreated Riparian Reserves, all of which may be impacted if they contain older snags that pose a safety hazard to the logging operations. Many of the plantations proposed for thinning in both alternatives have low or no large snags present currently, so few large snags are expected to be lost in those areas. Green Mountain design features (see Chapter 2) to create variable levels of snags ranging from 0-5 snags/acre, and protect existing snags where possible would mitigate this effect. For the regeneration harvest units, these recommendations would retain snags in the harvest units at 100 percent population potential (Neitro et al. 1985), well above the minimum Forest Plan standard of 40 percent. Acres with relatively higher levels of snags would also increase over time, especially within those units with a higher number recommendation. In the long-term over many decades, there would be fewer snags on these acres compared to Alternative 1, yet wildlife tree treatments would help improve this habitat. Recommended levels of wildlife tree treatments are shown in the Green Mountain Project design features (see Chapter 2). Those treatments in the regeneration harvest units are of a higher priority than those in previously managed stands.

With the Green Mountain Project design features (See Chapter 2) that recommend post-harvest monitoring and falling 0-5 trees per acre if these levels are not present, downed wood levels would initially increase on 4,405 and 3,961 acres of forest in Alternatives 2 and 3, respectively. The level of dead wood creation would exceed the minimum levels needed under Forest Plan standards and guidelines for regeneration harvest. Created snags would also contribute to future dead wood in the units, but, long-term over many decades there would be less downed wood in the harvested acres compared to Alternative 1because timber harvest would remove much of the future deadwood source.

The proposed Green Mountain harvest alternatives would affect snags and downed logs on approximately4 percent of the Green Mountain project area. No other timber harvest is reasonably foreseeable on Forest Service lands in the Green Mountain project area. Clearcut harvesting is expected to continue on the 1,622 acres of private lands in the northwest area of the watershed. These private lands are mostly previously logged forests with current low levels of snags and downed logs. Considering cumulative effects, downed wood levels in the South Fork McKenzie River watershed are expected to remain within historic levels and increase over time as past regeneration harvest areas on federal lands mature. Snag levels in the watershed are expected to initially remain below historic levels in the Westside Lowland Conifer-Hardwood Forest habitat. Snag levels are expected to increase over time, however, and return to the range of historic variability as past regeneration harvest areas on federal lands develop towards mature and older forest stages.

Because leave trees would be retained, and snags and downed logs would be created well above minimum Forest Plan Standards and Guidelines, the proposed Green Mountain Project would degrade, but not remove, habitat for most cavity excavators.

There may be benefits to treating the older stands above 80 years of age in Alternative 2 to Northern flickers especially in the older stands above 80 years of age in Alternative 2 since they prefer large snags, forest edges, and open forest habitat, all of which would be created by the silviculture treatments. Pileated woodpeckers are expected to continue to use the older stands after treatment since they are known to use shelterwood harvest areas (Forest Service 1990: III-73). Assuming that suitable owl habitat would be preferred pileated woodpecker habitat. Alternative 2 would degrade 410 acres or 1 percent of this habitat in the Green Mountain project area. Alternative 3 would not treat any suitable spotted owl habitat and would thus not degrade any pileated woodpecker habitat.

Cumulative Effects – Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Alternatives 2 and 3Using the combined acres of suitable and dispersal owl habitat, which represent forests with trees capable of producing 11 inches and larger snags, as a proxy for general cavity excavator habitat, Alternatives 2 and 3 would degrade 6 percent of the habitat in the Green Mountain project area. Hazard tree removal along the haul route is also expected to result in a very slight additional decrease in snag habitat within the project area. The Road 19 Salvage Project is a recently completed project that felled and removed 120 trees of variable diameters, some of which are currently snag habitat. The 2012 and 2014 prescribed burn as part of the Chucksney Grasshopper Ridge Meadow Restoration Project created less than 30 acres of additional large snag habitat both within and along the edges of the treated meadows within the Green Mountain project area. An additional 48 acres of meadows were burned in 2015 at Murphy Meadow which contributed additional large snag habitat for cavity nesters (Appendix F).

No other regeneration harvest or thinning project is reasonably foreseeable in the Green Mountain project area on Forest Service lands. The private lands that make up 2 percent of the Green Mountain project area are expected to remain relatively low quality habitat for cavity excavator MIS and pileated woodpecker. Because Alternatives 2 and 3 would impact only a small amount of the available habitat, snag and downed wood mitigation measures would be implemented, the individual MIS species are not on any viability “watch-list”, and, considering cumulative effects, future down wood and snag levels are expected to increase as past clearcuts on Forest Service lands mature, Alternatives 2 and 3 are both expected to maintain population viability of cavity excavator species and pileated woodpeckers in the Green Mountain project area and South Fork McKenzie River watershed, and would not contribute to any loss of viability of these species at the larger Forest scale.

Direct and Indirect Effects – Elk and Deer

The geographic scale used to assess direct, indirect and cumulative effects for elk habitat includes the ten Emphasis Areas within which management activities would occur (Figure 26). These emphasis areas were used for the scope of analysis because of established ratings and guidelines for elk habitat as described in the Willamette National Forest Plan. Each emphasis area has been assigned a rating of high, moderate, or low. Standards and Guidelines for management of these areas were developed in cooperation with the Oregon Department of Fish and Wildlife. These areas are managed for elk habitat under guidance from the Willamette Forest Plan Standards and guidelines (FW-137) with the assumption that providing quality elk habitat would adequately address the needs for black-tailed deer.

Wisdom Elk Model Variables for the Green Mountain Project Area

Size and Spacing of Forage: The size and spacing habitat effectiveness rating (HEs) for forage is not being met in all four high emphasis areas and the Roaring River moderate emphasis area.

Road Density: Road densities currently meet and would continue to meet the Forest Plan standard in all but two moderate emphasis areas: Green Ridge and Hardy. Many road miles are currently not open or drivable due to gates, berms, or safety reasons.

Cover: The habitat effectiveness values for cover (HEc) are low in all of the emphasis areas even within the Rebel and South Fork-Mink emphasis areas which are mostly in wilderness. This is due to the fact that much of this cover is not optimal thermal or older forested habitat. Elk were once also thought to require thermal cover in order to maintain body temperature. Recent work in northeast Oregon has shown this is not the case (Cook et al. 1998). No beneficial effects of thermal cover were demonstrated.

Forage: Forage quality habitat effectiveness ratings (HEf) for the Green Mountain project area were meeting Forest Plan standards in 2004, however forage quality is declining as past clearcuts regenerate into conifer regrowth. There has not been any heavy thinning, regeneration harvest or large fires within the project area within the past 15 years to create additional high quality forage.

Habitat Effectiveness Index (HEI): Overall ratings of (HEI) indicate that two emphasis areas are currently above Forest Plan standards: Hardy (0.53), and Cougar (0.33). The overall HEI ratings for Rebel, Cascade, South Fork-Mink, Elk, Green Ridge, Starr, Upper Augusta, and Roaring River are below Forest Plan standards (Table 47).

Table 47. HEI Analysis for Elk Habitat in the Green Mountain Project Area (Current Condition)

Emphasis Area Name	Emphasis Rating	Results for Each Model Variable					
		Year	HEs	HEr	HEc	HEf	Overall HEI
Rebel	High	2004	0.26	0.70	0.21	0.98	0.44
Cascade	High	2004	0.31	0.52	0.21	0.83	0.41
South Fork-Mink	High	2004	0.12	0.79	0.33	0.89	0.41
Elk	High	2004	0.32	0.57	0.32	0.92	0.48
Green Ridge	Moderate	2004	0.76	0.35	0.24	0.82	0.48
Hardy	Moderate	2004	0.84	0.36	0.28	0.90	0.53
Starr	Moderate	2004	0.59	0.41	0.16	0.94	0.44
Upper Augusta	Moderate	2013 (HEr); 2004	0.44	0.45	0.17	0.93	0.43
Roaring River	Moderate	2004	0.15	0.51	0.28	0.92	0.38
Cougar	Low	2004	0.35	0.22	0.17	0.91	0.33

Target Levels:
High Emphasis Area - Individual Index: >0.5 Overall Index: >0.6.
Moderate Emphasis Area - Individual Index: >0.4 Overall Index: >0.5.
Low Emphasis Area - Individual Index: >0.2 Overall Index: increase any variable <0.2.

Values shown in gray shaded boxes are below recommended minimum threshold levels in the Willamette National Forest LRMP.

Westside Elk Model for the Green Mountain Project Area

Recent research has found that the quality and quantity of summer and fall forage is of great importance to elk populations. An increase in summer and fall elk forage quality can directly increase calf weights prior to winter, overwinter calf survival, pregnancy rates, adult fall fat accumulation, and herd productivity (Cook et al. 2004). The benefits of increased summer forage quality that have been demonstrated for elk are also expected for deer. The Westside Elk Model was developed to estimate how silviculture treatments affect summer forage quality in western Oregon (Rowland et al. 2013).

Elk Nutrition Model: The nutrition model predicts dietary digestible energy (DDE) that elk can acquire from each plant community during summer. Digestible energy levels in elk diets in summer are affected by nutritional adequacy of the various vegetation communities used by elk while foraging and are related to reproduction and survival in summer and subsequent seasons. The nutrition model predicts DDE for landscapes. There are four inputs to calculate dietary digestible energy: potential natural vegetation (PNV) zone, modeling region (1 of 3), canopy cover (%) of live trees, and proportion of total live trees (>2.5 cm diameter breast height) that are hardwoods.

Elk Habitat Use Model: The key components that have been identified as important for predicting elk habitat use are: 1) dietary digestible energy (higher DDE, higher predicted elk use), 2) distance to roads open to public access (farther from roads, higher use), 3) percent slope;, and 4) distance to cover/forage edge (closer to edge, higher use).

Alternative 1 – No Action

Alternative 1 would maintain the current low quality big game forage levels in the project area. Current trends of elk habitat development would occur naturally over time with Alternative 1. Existing elk foraging habitat within the few remaining open plantations would continue to grow denser into hiding cover, and then into thermal cover. Some of the current foraging habitat areas are in higher elevation frost pockets that may be maintained in a long-term (over 50 years) foraging habitat condition. With Alternative 1, current elk effectiveness ratings would not change significantly within the next few decades.

In ten years, forage availability would be expected to decrease further in the Green Mountain project area. In the absence of additional harvest or wildfire, no new foraging areas would be created. Current amounts and quality of optimal and thermal cover would not significantly change. In 50 years, approximately 30% of the existing thermal cover would shift into optimal cover. Road density and big game security would not change. Overall habitat quality would decrease from the loss of forage.

The present high amount of poor and marginal quality forage is consistent with range conditions where declining big game abundance is likely (Cook et al. 2004). The results of the elk nutrition model analysis shows that all of the ten emphasis areas currently have most of their acres (46-93%) in Category 2 which is a marginal nutrition value. Six of the emphasis areas have a substantial proportion (20-44%) of their area in a poor nutritional value (Table 48). Each of the ten elk emphasis areas in the Green Mountain project area has a very small percentage of the area in a good to excellent condition, ranging from a total of 7% in the Upper Augusta elk emphasis area to only 1% in an excellent condition in the South Fork Mink elk emphasis area. The good to excellent forage appears to be distributed in small habitat patches throughout the Green Mountain project area. About 600 acres of private lands that occur in the Cougar emphasis area were not considered in this analysis. Much of that area has been clearcut and currently provides forage habitat although it is being managed for timber production and the shrub/hardwood/forb component which provides forage is likely low.

Alternative 2

With Alternative 2, the proportion of area the marginal DDE classes would increase due to acres within the poor DDE class being thinned (Table 48). In some cases i.e. the Roaring River elk emphasis area, the proportion of acres within the good DDE class doubles from 3% to 6% which is due to proposed shelterwood regeneration harvest. The Hardy emphasis area would also show a similar increase in the proportion of area that would be within a “good” DDE class from 2% to 6%. Some of the other elk emphasis areas do not show large improvements in the proportion of area in the “good” and “excellent” DDE classes which is due to less acres of treatment within their boundaries, as well as lighter thinning treatments (Elk, Cougar, Starr, Cascade, South Fork Mink, and Rebel).

Alternative 3

Since Alternative 3 does not include any regeneration harvest, the elk nutrition model shows little change from Alternative 1-No Action (Table 48). Notable are changes in the Hardy elk emphasis area where the proportion of habitat in the poor DDE class is reduced from 20% under Alternative 1, to 16% under Alternative 3 which is due to heavy thinning treatments that result in more forage availability than lighter thinning treatments. The proportion of DDE class “good” moves from 2% under Alternative 1 to 6% under Alternative 3 for the Hardy elk emphasis area.

Table 48. 2016 Analysis of DDE Categories by Big Game Emphasis Area

Alternative 1 - Current Condition										
DDE Class	Elk	Greenridge	Cougar	Roaring River	Hardy	Starr	Cascade	South Fork Mink	Upper August	Rebel
Poor	4%	44%	32%	7%	20%	44%	34%	7%	14%	36%
Marginal	93%	46%	49%	87%	73%	51%	60%	90%	79%	59%
Good	1%	2%	3%	3%	2%	2%	2%	0%	4%	2%
Excellent	1%	3%	3%	2%	4%	2%	2%	1%	3%	2%
No Data	1%	5%	13%	1%	1%	1%	2%	2%	0%	2%
Alternative 2										
DDE Class	Elk	Greenridge	Cougar	Roaring River	Hardy	Starr	Cascade	South Fork Mink	Upper August	Rebel
Poor	4%	32%	32%	7%	16%	38%	34%	7%	14%	36%
Marginal	93%	50%	49%	84%	73%	57%	59%	90%	79%	59%
Good	1%	9%	3%	6%	6%	2%	2%	0%	4%	2%
Excellent	1%	3%	3%	2%	4%	2%	2%	1%	3%	2%
No Data	1%	5%	13%	1%	1%	1%	2%	2%	0%	2%
Alternative 3										
DDE Class	Elk	Greenridge	Cougar	Roaring River	Hardy	Starr	Cascade	South Fork Mink	Upper August	Rebel
Poor	4%	33%	32%	7%	16%	38%	34%	7%	14%	36%
Marginal	93%	50%	49%	87%	73%	57%	59%	90%	79%	59%
Good	1%	9%	3%	3%	6%	2%	2%	0%	4%	2%
Excellent	1%	3%	3%	2%	4%	2%	2%	1%	3%	2%
No Data	1%	5%	13%	1%	1%	1%	2%	2%	0%	2%

Alternatives 2 and 3

Based on the elk nutritional model (Rowland et al. 2013), regeneration harvest and 1-3 acre gaps in Alternatives 2 and 3 should increase elk forage quality from "poor "to "higher-marginal" for approximately 20 years on approximately 932 and approximately 473 acres, respectively. The proximity to open roads would somewhat limit use in the units, especially for elk, but would not preclude foraging because the roads are overall lightly traveled by motorized vehicles, especially at night. Overall higher big game use would be expected after logging than is currently found in the units. In addition, acres that would be thinned would also respond with forage improvements, especially those units that are more heavily thinned. The two additional Elk Emphasis Areas Rebel and Cougar overlap the Green Mountain project area; however they do not have any harvest units proposed within their boundaries. Proposed harvest treatments would improve the eight BGEAs within which Green Mountain proposed harvest units occur as shown in Table 49.

Table 49. BGEA Improvements with Proposed Harvest Treatments

Emphasis Area Name	Emphasis Area Rating	Acres	Acres of Regen/% of BGEA[1]	Acres of Thinning/% of BGEA[1]	Total % BGEA Forage Quality Improved
Rebel	High	6833	0	0	0
Cascade	High	7769	0	266	3
South Fork-Mink	High	21,958	0	45	0.2
Elk	High	13,786	11	214	2
Green Ridge	Moderate	8027	397	1514	24
Hardy	Moderate	4902	90	689	16
Starr	Moderate	5018	0	464	9
Upper Augusta	Moderate	11,104	0	374	3
Roaring River	Moderate	8836	76	268	4
Cougar	Low	8141	0	0	0

[1] Note these acres are the unit footprint acres and include skips.

Forage quality for elk would be most dramatically improved within the Green Ridge Elk Emphasis Area which would have 397 acres regeneration harvested under Alternative 2 (Table 49). Combined with the proposed thinning on approximately 1,514 acres, approximately 24 percent of the entire elk emphasis area would show improved forage conditions. The Hardy elk emphasis area would have forage conditions improved over 16 percent of its' area. The difference in forage habitat for the Green Ridge and Hardy elk emphasis areas is expected to result in higher elk numbers and improved hunting success in those two areas over the next 10-15 years. The other elk emphasis areas would show more minor improvements in their forage habitat conditions. In addition to what is shown in the Table above, proposed gap treatments would also contribute to improved elk forage conditions on 318 and 261 acres for Alternatives 2 and 3, respectively.

The changes in predicted elk habitat use for Alternative 2 compared to Alternative 3 are minor when considered at the scale of each elk emphasis area and the entire Green Mountain project area as determined by the elk habitat tool. The most noticeable change would be an approximately 12% increase in elk habitat in the Hardy elk emphasis area with Alternative 2, compared to an increase of approximately one percent with Alternative 3 Figure 27.

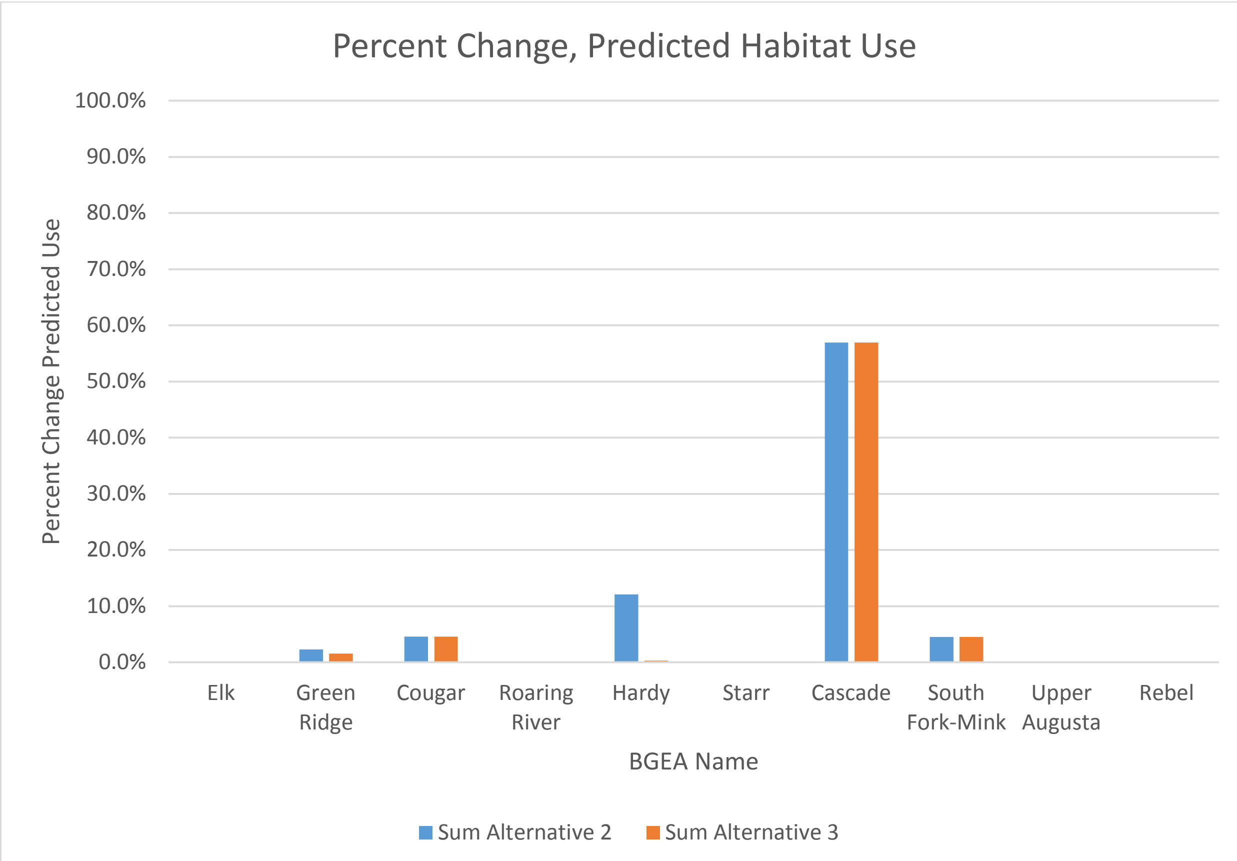


Figure 27. Summary of Predicted Elk Habitat Use in Green Mountain Project Area by Alternative

While the Westside Elk Model does consider open road densities and the disturbance that open roads cause to elk, it does not calculate a road density value because this is already considered in the overall calculation. Both Alternatives 2 and 3 would store or decommission Forest Service Roads that are currently open and drivable With the exception of the following, these road management changes are minor and consist of storing or decommissioning small spur roads under 0.5 miles in length (Appendix D- Road Treatment Proposals).

Replacement of the currently closed Hardy Creek bridge on Forest Service Road 1980-204 would again open up approximately 5.5 miles of road in an approximately 1,000 acre area to vehicles that has been closed for about 6 years, which may reduce security for elk on winter range in the Starr moderate elk emphasis area. The open road density is currently approximately 1.6 miles of open road per square mile. Replacement of the Hardy Creek Bridge would result in an open road density of approximately 2.1 miles of open road per square mile, which is still above the 1990 Willamette LRMP standard for the road density variable (FW-151) of less than 2.9 miles of open road per square mile for moderate elk emphasis areas. About 1.8 miles of road behind the Hardy Creek bridge gate is not being managed as an open road and is already brushy and non-drivable at this time or would be in the future (roads 1980255, 257, 260, 266, 265, 213, and 214). Of these latter roads, approximately 1.5 miles would be opened for harvest activities with Alternatives 2 and 3. Upon completion of activities, these roads would be reclosed (stored) and put back into a lower maintenance level condition and not be drivable.

Removing the seasonal winter closures of Forest Roads 1900-430 and 1900-431 (approximately 11.6 miles) would allow future year-round access on approximately 7.4 miles of road. Up to 4.4 miles of this road system is planned for future storage level 1 and is planned to be closed to vehicle access once funding is obtained. Forest Road 1927-240 would have a year-round vehicle gate closure on the uppermost 3.7 miles, with the lower portion of this road open, compared to the current seasonal closure. The new year-round closure on the uppermost 1927240 road would benefit elk and many other wildlife species who need seclusion in the Upper Augusta elk emphasis area.

All of these road systems generally receive low use with the exception of the fall hunting season, so in total any impacts to elk and other wildlife from opening these road systems are judged to be minor. A seasonal road closure has not been counted in terms of road density calculations and a year-round closure would be more effective and easier to implement. Both Alternatives 2 and 3 would decommission approximately two miles of road, and store approximately 21 miles.

Table 50. Open Road Mileage for the Green Mountain Project

Forest Road	Miles to be opened	Miles to be closed year-round by gate of maintenance level 1 which is not drivable.	Miles difference
1980204	5.5	1.9	+5.5
1900430 and 431	11.6 - Current seasonal winter closure only	4.4	-4.4
1927240	Current seasonal closure only	3.7	-3.7

Elk Population Estimates

Past harvest activities have shaped the landscape in terms of the types of elk habitat. Harvest treatments were primarily regeneration, which included clearcuts and shelterwoods. These harvested units once provided a wealth of quality forage for elk but have since grown into hiding and thermal cover. No specific data is available for the local elk/deer populations within the ten Emphasis Areas that this project overlaps. Current ODFW biological data are not sufficient to provide an accurate estimate of the black-tailed deer population in western Oregon (ODFW 2002). Recent ODFW elk population estimates show that the state management unit in vicinity of the project area (McKenzie) has elk herds with population numbers near their current management objectives (Brian Wolfer, pers. com; ODFW 2014).

Oregon Department of Fish and Wildlife (ODFW) developed a statewide management plan for elk in 2003 and for black-tailed deer (ODFW 2003; ODFW 2008). These plans, as well as the modeling and research efforts discussed above, are noting the need for improved quality forage areas on National Forest lands. With the cessation of large-scale clearcutting in Northwest National Forests, forage quality and populations have declined in the forest for both deer and elk as estimated from 1990-2010. This trend is continuing to the present.

Elk harvests and hunter success peaked in the late 1990s in the Wildlife Management Units (WMUs), and have declined since then (ODFW 2003). The estimation of elk numbers is not an exact science. The professional conclusion of ODFW area managers (based on minimum known elk numbers, estimates of animals missed during surveys and the amount of areas lacking counts) is that the WMUs that overlap the Willamette National Forest are each substantially below State Population Management Objectives (Brian Wolfer, pers. com. 2014).

Twenty units have design features to reduce the effects of road disturbance to elk by maintaining a visual screen along a 50 foot roadside buffer in which trees would not be thinned (Refer to Design Features in Chapter 2). These units were selected based on their current and expected future value to elk and specifically, foraging habitat. Reducing visual disturbance from vehicles increases elk security and may help reduce their energy needs.

Cumulative Effects – Elk and Deer

Alternative 1 – No Action

It is expected that with Alternative 1, most of the elk and deer forage habitat would continue to be created at the lower elevations in the Cougar elk emphasis area on private land. Combined with other recently completed projects such as the recently completed Cascade Thin, Murphy Meadow and Chucksney Grasshopper projects, overall forage habitat conditions would continue to remain at an overall low quality within the Green Mountain project area.

Alternatives 2 and 3

Past actions that have improved elk forage habitat in the Green Mountain project area include about 261 acres of timber harvest that have occurred since about 2000 (Appendix F) which were all commercial thinning. Many of these stands have grown in considerably since then, however those that had more open canopies continue to function as improved foraging habitat. Cascade Thin was completed in 2013 and included thinning on approximately 45 acres, with an additional approximately 10 acres of gaps which currently provides high quality forage habitat. The Chucksney Grasshopper Ridge Meadow Restoration Project has maintained about 50 acres of early seral habitat in the Green Mountain project area, with an additional approximately 48 acres that were burned in upper and lower Murphy Meadow in 2015 which provides high quality elk and deer foraging habitat. There are no other ongoing or reasonably foreseeable activities on National Forest System lands in the Green Mountain project area that would create high quality forage habitat for deer and elk. There are no other ongoing or reasonably foreseeable activities on National Forest System lands in the Green Mountain project area that would create high quality forage habitat for deer and elk. Clearcut logging is expected to continue on private lands in the very northwest portion of the project area,

In the context of the Emphasis Areas and adjacent 5th field watersheds, the Green Mountain project effects would result in a minor contribution to cumulative effects. Given what is currently known about local deer and elk populations, the future viability of these species is assured and they would continue to benefit from habitat restoration opportunities that continue to be implemented – especially when conducted at an appropriate scale.

Direct and Indirect Effects – Marten

Alternative 1 – No Action

Alternative 1 would maintain the current forest habitat and the stands would continue to develop large diameter trees, large snags, and large downed logs as the stands progress into old growth forests. Structural features that marten prefer would continue to increase over time.

Alternative 2

Alternative 2 would adversely impact 236 acres of marten habitat in the montane forest type which appears to be a preferred forest type used by marten. Seventy-one acres which are proposed for regeneration harvest would be removed as marten habitat until the stands recover to late-successional habitat conditions in approximately 100 years or more. One hundred and sixty-five acres in the montane forest habitat type would be thinned, which would degrade this marten habitat for several decades. The recommended wildlife tree and large down wood habitat creation would improve these stands as marten habitat for about a century until the trees fall and the logs decay by providing habitat structures preferred by this species and their prey.

Alternative 2 would adversely impact a total 412 acres of marten habitat in all forest habitat types in older stands over 80 years of age, until these stands regenerate. Seventy-one of these acres would be regeneration harvested, and 325 acres would be thinned which would have a lower impact on marten habitat quality.

Low quality potential marten habitat may exist in the 3,960 acres of younger stands in Alternative 2 which would be degraded. Note, these stands include the total unit footprint which also includes skips which would not be harvested. With the recommended wildlife tree and down log creation activities, structural elements that make up higher quality marten habitat would be improved which may benefit marten.

Because of the extremely limited extent that the Green Mountain Project would affect the preferred higher elevation montane mixed forest habitat, overall impacts to marten are judged to be discountable. With implementation of Alternative 2, the long-term (>50 years) viability of marten populations is expected to continue to persist across the Green Mountain project area in this habitat type.

Alternative 3

Alternative 3 would neither include any regeneration harvest, nor would it include any units in higher quality montane forest wildlife habitat which appears to be preferred by marten. This alternative would include only thinning units. If harvest under this alternative is followed up with wildlife tree and down wood habitat creation, the abundance of some of the structural features that marten prefer would be improved, and they may benefit slightly on the 3,327 acres of this alternative. Over the next several decades, as these younger stands eventually grow older and the trees grow larger, marten habitat would continue to improve.

Cumulative Effects - Marten

Alternative 2 and 3

No other future projects are reasonably foreseeable that would reduce the amount of older forest habitat in the Green Mountain project area. Because of the limited extent that the Green Mountain Project would affect higher elevation montane mixed forest habitat that marten prefer, the long-term viability of marten populations over the next several decades is expected to continue to persist across the project area. Effects to marten from actions proposed in the Green Mountain Project do not overlap in time and space with effects from any past, present or reasonably foreseeable future actions and therefore, the Green Mountain Project has no cumulative effects on marten.

Direct and Indirect Effects – Migratory Birds

Alternative 1 – No Action

Alternative 1would have no direct effect on migratory bird habitat and would not increase habitat for early-seral species. The Green Mountain units would continue to develop towards old growth forest conditions, resulting in improved nesting and foraging habitat for northern goshawks and other species that prefer this habitat.

Alternative 2

Alternative 2 would remove approximately 71 acres over 80 and up to 135 years of age, and thin approximately 276 acres over 80 and up to 144 years of age. These older stands provide habitat for bird species like the northern goshawk, which prefer older conifer forests. These stands currently provide foraging and potential nesting areas for goshawks. One goshawk was detected in one of these older stands, however a nest has not been found. Protocol nest surveys have not been completed. Mitigation measures would protect any raptor nests that are incidentally found in the harvest units during layout or implementation. Retention of some overstory trees would slightly reduce the amount of time required to regenerate the stands back to foraging and nesting habitat. In approximately 80 years after timber harvest, the treatment units would return to suitable goshawk foraging and nesting habitat. Using suitable spotted owl habitat as a proxy for suitable goshawk habitat, Alternative 2 would impact 1 percent of the suitable goshawk habitat in the Green Mountain project area.

Alternative 2 would allow natural regeneration to be used for DTRs, and approximately 210 acres of 1-3 acre gaps would not be planted following harvest. This would benefit migratory birds that use this complex early seral habitat. Gap placement would avoid steep, rocky areas and favor deep soils and areas where the understory would readily develop. The resulting open habitat is expected to last for approximately 15 years at the lower and moderate elevations up to approximately 3500' in the one-acre gaps until they fill in naturally with conifer seedlings. The larger 2-3 acre gaps may remain as open habitats for approximately 20 years if they are not planted. Lower elevation gaps are expected to close in faster than higher elevation gaps. The species mix in the lower elevation gaps would differ somewhat from the gaps above 3500'. Lower elevation gaps would include vine maple, deerbrush, red alder, Oregon grape, red huckleberry and native grasses. The higher elevation gap species may include huckleberry, beargrass, vine maple, native grasses and many flowering forbs, the seeds of which benefit some species of migratory birds, as well as pollinators.

Alternatives 2 and 3

Both action alternatives are consistent with the Migratory Bird Treaty MOU. Seasonal restrictions are recommended in the Green Mountain Design Features (Chapter 2) to conduct hazard tree falling outside the critical nesting season, as well as tree felling, yarding and prescribed unit underburning on specific units to protect raptors and owls. This would minimize disturbances to nesting migratory birds and reduce the likelihood of harm to individual birds. It is not operationally feasible to seasonally restrict falling operations in every harvest unit. Designs features to retain existing snags where possible, and to retain live trees, create snags, and fall trees for dead wood sources would provide structural features migratory birds would use.

There is a design feature (Chapter 2) to consider late winter or fall for prescribed underburning which would reduce impacts to nesting birds and their young. The traditional timeframe for spring underburning between March and late June coincides with the nesting period for most migratory birds. Fire in harvest units during nesting season may cause nest abandonment or mortality of eggs or juveniles. In past years, late winter weather has frequently created favorable conditions for underburning. There are opportunities to also consider early fall for prescribed underburning post-harvest unit, topographical, as weather and operational conditions allow. It is unlikely that all prescribed underburning units could be fall burned because the weather window for successful implementation is usually very short, and does not even occur in some years.

Alternatives 2 and 3 would provide 932 and 473 acres, respectively, of complex early seral habitat. These acres include regeneration harvest, dominant tree release (DTR), and gaps. Migratory birds which favor shrub habitat in early seral conifer stands, such as the Rufous hummingbird and purple finch, would benefit for approximately 20 years or until dense conifer regrowth reestablishes in the units. Species, such as olive-sided flycatcher, which favor forest openings with large snags, would likely benefit for as long as the snags remain, which could be 30 or more years. Alternative 3 would have the same beneficial effects on migratory birds although fewer acres (214 acres) of gaps would be created and left unplanted. Both Alternatives 2 and 3 would include underburning on approximately 795 and 282 acres, respectively, as well as slash burning on 2,532 and 2,705 acres, respectively. While fire managers are attempted to conduct more underburning and slash treatments in the fall, due to a very small suitable burning timeframe in the fall, most of this work would take place during the spring which may cause adverse effects to nesting migratory birds. The exception is the burning of slash piles which is generally scheduled for the fall.

Cumulative Effects - Migratory Birds

Alternative 2 and 3

The Green Mountain Project would be the first regeneration timber harvest in the Green Mountain project area since the late 1990s to early 2000s on FS lands, and no other regeneration harvest is reasonably foreseeable on the federal lands in this watershed. About 100 acres of complex early seral habitat has been created by wild fires in the Green Mountain project area in the past 50 years. Less than 50 acres of forest gaps in commercial thinning units have been created in the Green Mountain project area in the past 30 years. The Chucksney Grasshopper Ridge Meadow Restoration Project has maintained approximately 50 acres of early seral habitat at higher elevations in the Green Mountain project area, with an additional approximately 48 acres that were burned in upper and lower Murphy Meadow in 2015 (Appendix F) which will provide additional early seral habitat for migratory birds such as rufous hummingbird and purple finch.

Cumulatively, these actions would provide early seral habitat in 1 percent (Alternative 2), and 0.6 percent (Alternative 3) of the Green Mountain project area. An increase in seral dependent migratory birds would be expected in the regeneration and gap treatment units, and forest edges adjacent to the units, but the increase in birds would be minimal at the landscape level. The 1.6 percent of the Green Mountain project area that is private timber lands would likely continue to provide some lower-quality early seral bird habitat where stands have been recently clearcut.

No other projects that remove older forest habitat are reasonably foreseeable in this watershed or project area. With Alternative 2, viable populations of goshawks and other migratory birds that use older conifer forests are expected to be maintained at the landscape level because approximately 59 % of the Green Mountain project area would remain older forested habitat. Alternative 3 would not modify any older forested habitat.

3.6 Botany and Invasive Plants

3.6.1 Scale of Analysis

The scale of analysis for botanical resources is limited to the units proposed for treatment in the Green Mountain project area.

3.6.2 Affected Environment – Special Status Botanical Species

Current management mandates conservation of several categories of special status plants on the Willamette National Forest. These include species from the Regional Forester Sensitive and Strategic Plant lists. Special status species are protected by USDA Forest Service regulations and manual direction (FSM 2672.4).

Numerous special status plants on the Regional Forester Special Status Species list for the Willamette National Forest have potential to occur in the Green Mountain project area, which encompasses a wide range of western Cascade forest habitats. These species are found in the Biological Evaluation in the Project file.

The project area was reviewed summer 2011-2012, using intuitive controlled surveys, in which the surveyor traversed through the project area enough to see a representative cross section of all the major habitats and topographic features, looking for the target species while in route between different areas. When the surveyor arrived at an area of potential habitat, which was defined in the pre-field review or encountered during the field visit, a complete survey for the target species was made.

Although potential habitat occurs for special status fungi in the project area, no surveys for these species were conducted because they are deemed infeasible.

Unit surveys resulted in the discovery of two species that are currently listed as sensitive within the project area (Table 51).

Table 51. Special Status Botanical Species in the Green Mountain Project Area

Proposed Units	Sensitive Species	No-Disturbance Buffer
260, 580, 990	*Blephasostoma archanoidium*	180ft.
1680	*Lobaria linita*	180 ft.

- *Blephasostoma archanoidium* is a moss that grows on rotting wood at middle to higher elevations. It is listed as Region 6 sensitive and it known from California, Washington, and British Columbia.
- *Lobaria linita* is a lichen that grows in trees from coastal Alaska to northwest Oregon and inland to western Montana.

3.6.3 Environmental Consequences – Special Status Botanical Species

Direct and Indirect Effects

Alternative 1 – No Action

This alternative would have no effect on special status botanical species because habitat modification as a result of timber harvest would not occur in the project area.

Alternative 2 and 3

There would be no effect on special status lichens, bryophytes or vascular plants in the Green Mountain project area from timer harvest under either action alternative because known sites would be buffered from harvest and ground-disturbing activites. These buffers would maintain microclimatic conditions (i.e. temperature and atmospheric moisture) as well as maintain suitable substrate sources for propagule dispersal.

Lichenologists do not have a clear understanding of how smoke and atmospheric change affects lichens; they know many of these plants are sensitive to such changes and use them as indicators of air quality. Without knowing for certain, a change air quality may affect reproductive vigor of sensitive lichen species, even with the protection buffer. Lichen sites in units proposed for post-harvest underburning could be impacted by post-harvest fuels treatments (McCune and Geiser 1997). Higher than expected fire intensity from underburning could potentially consume a known population or mortally weaken the host tree.

Without knowing for certain the presence or absence of these fungi in the Green Mountain project area, a reasonable assumption is there will be some localized effects to individuals from activities proposed in the Green Mountain project. These potential localized effects are specific to fungi only.

Timber harvest could impact some fungi in the project area as a result of soil compaction and microclimatic change by increasing the effects of solar radiation through canopy removal (Griffiths and Swanson, 2001). The thinning and gap creation would have the same effect of regeneration harvest, but to a lesser degree based on spatial impact. Alteration of seral stage creates a a change in underground fungal species diversity and regeneration harvest does diminish the richness of ectomycorrhizal species (Byrd, et al., 2000). Logging intensity has also been shown to affect abundance and composition of ectomycorrhizal fungi (Durrall, et al., 2006).

Both natural fuels and post-harvest under burning have potential to affect fungi species. Research indicates diversity in ectomycorrhizal species, live root biomass, and duff levels are significantly reduced by prescribed fire, compared to non-burned treatments (Smith, et al., 2005). It should also be noted, the majority of fungal species diversity resides in mineral soil (Bruns, et al., 2002). Considering, fire behavior can be unpredictable; effects could occur from a change in expected fire severity during under burning operations. As a consequence, high intensity fires may kill fungi in mineral soil (Dahlberg, 2002). The burn season would affect fire severity, with fall and spring burns having differential influences on the community structure and abundance of ectomycorrhizal fungi (Dahlberg, et al., 2001). Pile burning will likely have effects in terms of radiant heat impacts; since concentrated burning can result in localized higher fire intensities and changes in fungal species diversity (Baar, et al., 1999).

There could be effects from a loss of host trees as a result of timber harvest and there could be effects due to fuels treatments. Research has found fungal reproduction was not significantly affected at the 40 percent retention level, but was almost eliminated at the 15 percent retention level. (Luoma, et al. 2004). The Green Mountain project proposes 320 acres of gaps under the Alternative 2. However, Alternative 2 proposes treatments (i.e. regeneration harvest) that would reduce tree retention in some stands closer to the 15% threshold where effects to sensitive fungi have been observed.

It is assumed timber harvesting would affect some fungi not known to occur in the project area through soil compaction and microclimatic change by increasing the effects of solar radiation through canopy removal (Griffiths and Swanson, 2001). The extent of this effect is not completely known, but the risk of adverse effects would be related the degree of the exisiting soil conditions. For more information about soils in relation to Forest Plan compaction thresholds, see the Soils Analysis section of the Green Mountain EIS. Alteration of seral stage creates a change in underground fungal species diversity and regeneration harvest does diminish the richness of ectomycorrhizal species (Byrd, et al., 2000). Logging intensity has also been shown to affect abundance and composition of ectomycorrhizal fungi (Durrall, et al., 2006).

Gaps could have additional effects on fungi species potentially occurring in the project area by removing host trees of from their inoculum source. Ectomycorrhizal root tip density drops greatly when the distance from gap edge exceeds 10 meters (Berglund and Jonsson, 2003). No harvest areas (skips) would be retained in units with gaps and may allow for some level of mycelia retention. However, gaps greater than 10 m (approximately 33 ft.) from the next skip should be assumed to have some impact on fungi propagation.

Post-harvest underburning has potential to affect fungi species. Research indicates diversity in ectomycorrhizal species, live root biomass, and duff levels are significantly reduced by prescribed fire, compared to non-burned treatments (Smith, et al., 2005). It should also be noted, the majority of fungal species diversity resides in mineral soil (Bruns, et al., 2002). The burn season would affect fire severity, with fall and spring burns having differential influences on the community structure and abundance of ectomycorrhizal fungi (Dahlberg, et al., 2001). It should be assumed pile burning will likely have effects on some fungi in terms of radiant heat impacts; since concentrated burning can result in localized higher fire intensities and changes in fungal species diversity (Baar, et al., 1999).

Cumulative Effects

The cumulative effects analysis area for Special Status lichens, bryophytes and vascular plants is the Green Mountain harvest units because there is potential habitat for these species and any cumulative effect from the proposed actions is expected to occur within the harvest boundary. There are two known sensitive plants in the Green Mountain project area and they would be protected with a no-disturbance buffer; therefore, there is no cumulative effect to these species

Cumulative effects to fungi habitat can be estimated for each action alternative. Alternative 2 proposes 4,368 acres and Alternative 3 proposes 3,957 acres of harvest; while approximately 6,200 acres have been managed in the past. Alternative 2 would increase potential cumulative effects to fungi by approximately 71%, while Alternative 3 would increase potential effects by nearly 64%. Therefore, Alternative 2 carries a higher risk of cumulative effects to Special Status fungi species.

3.6.5 Affected Environment – Survey and Manage Botanical Species

This project is consistent with the January 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*.

This project utilizes the December 2003 species list. This list incorporates species changes and removals made as a result of the 2001, 2002, and 2003 Annual Species Reviews. The Green Mountain project area was surveyed during the summer of 2011 and 2012. The survey and manage tracking form is available in the project record. Survey and managed species found in the Green Mountain projet area are listed in Table 52 and described below.

Table 52. Survey and Manage Species in the Green Mountain Project Area

Proposed Unit	Survey and Manage Species	No-Disturbance Buffer
1890	*Chaenotheca subroscida*	30ft.
340, 380,200, 1500, 1861, 1940, 1930, 1920, 1592, 1320	*Peltigera pacifica*	**NA
1861	*Nephroma occultum*	30ft.
1590	*Rhizonium nudum*	60ft.
1680	*Lobaria linita*	180ft.

- *Chaenotheca subroscida* – Lichen found in humid, inter-montane old growth forests at lower and mid elevations, mostly restricted to the bark of old trees.
- *Peltigera pacifica* – Lichen found from coastal Alaska to Oregon, mainly in the western Cascades on soil, moss, rocks, logs and tree boles in low elevation, moist forests. All of the *Peltigera* populations are riparian and will be protected with riparian buffers
- *Nephroma occultum* – Lichen found on western slopes of Cascades in Douglas fir and western hemlock forests. It is one of the species most restricted to old-growth forests, but it may occasionally be found in younger forests.
- *Rhizomnium nudum* – Moss occurring in coniferous forests mostly at mid to high elevations. Generally the locations are in seepy areas or along the edge of a pond, wet meadow, or small stream.
- *Lobaria linita* – An epiphytic lichen found from the arctic to northwest Oregon, inland to Montana in habitats with moist, coastal influence.

3.6.6 Environmental Consequences – Survey and Manage Botanical Species

Direct and Indirect Effects

Alternative 1 – No Action

This alternative would have no effect on survey and manage species because habitat modification as a result of timber harvest would not occur in the project area.

Alternative 2 and 3

These alternatives would have the same effect on survey and manage species as they would on sensitive species because they are the same lifeforms and co-exist in the same or similar habitat.

Cumulative Effects

The cumulative effects analysis area for survey and manage species is the Green Mountain harvest units because there is potential habitat for these species and any cumulative effect from the proposed actions is expected to occur within the harvest boundary. There are five known sensitive plants in the Green Mountain project area and they would be protected with a no-disturbance buffer; therefore, there is no cumulative effect to these species

3.6.7 Affected Environment – Special Habitats

Special habitats are non-forested habitats that are limited in size and distribution across the landscape. Small, scattered habitats play important roles not only for perpetual occupants of the sites, but also for those organisms who use them seasonally, or for only a portion of their life cycles. Numerous factors contribute to the creation or maintenance of special habitats. Among such factors, topography and hydrology often determine the microclimatic conditions at these sites. Some features, such as rock outcrops, are static and remain on the landscape. Wetland special habitats can be ephemeral or perennial depending on the water source. Meadows are unique because these features can be created by a natural disturbances and processes. Conversely, they can also be lost to natural processes such as encroachment. See Table 53 for special habitats in potential Green Mountain harvest units.

Table 53. Special Habitats in the Green Mountain Project Area

Proposed Units	Special Habitat	No-Disturbance Buffer
5150, 90, 5750, 5750, 1550	seep/rock outcrop	*30 ft.
5160, 30, 150, 790, 5670, 840, 1090, 5470, 1482, 1450, 1980, 1540, 1940, 1100, 1040,	rock outcrop	*30 ft.
5360, 400, 600, 680, 1030, 1330, 1950, 1940, 1930, 1360, 1320, 1280, 5610, 42, 420, 5230, 380, 640, 1060, 1030, 1460, 1920, 110, 5460, 5260, 1200, 1310, 1500, 1861, 1350	Wetland/Seep/Swamp	**60 ft.
5660, 1280	mesic meadow	**60 ft.
5340, 150, 5450	vine maple talus	*30 ft.

*****No-disturbance buffer distance is based on Special Habitat Management Guide.
**Buffers will be expanded if Aquatic Resource Specialists recommend increasing them in order to maintain hydrologic function.

3.6.8 Environmental Consequences – Special Habitats

Alternative 1 – No Action

There would be no measurable effect to any seep/rock outcrop, rock outcrop, wetland type or vine maple talus with selecting this alternative.

The No-Action alternative may affect the meadow habitats in units 1280 and 5660 because it does not propose to harvest timber and would not remove adjacent seed sources that contribute to encroachment.

Alternative 2 and 3

The action alternatives would have no impact on special habitats. Special habitats would be buffered from harvest and ground disturbing activities because these habitats are not as common as forested habitats and they support plant communities that are different from those of coniferous forest. These buffers would maintain the microclimate, hydrology, and prevent damage to the areas during project implementation. Without the no-disturbance mitigation, reduced cover could potentially decrease humidity and increase temperature earlier in the growing season, thus altering habitat viability.

Cumulative Effects

The analysis area for special habitat cumulative effects is the Green Mountain units in which they are documented. This area was chosen because activities outside the analysis area would have no effect on special habitats located within the project analysis area.

There would be no effect to special habitats in the Green Mountain project area because of the no-disturbance buffer mitigation; therefore, there would be no cumulative effect from the proposed actions.

Based on the analysis of this project, there will be no incremental change to existing populations of special habitats in the project area as a result of selecting any of the alternatives. There are no foreseeable future actions (e.g. burning, encroachment thinning) that would contribute additional cumulative effects to special habitats within the project area.

3.6.9 Affected Environment – Invasive Plants

Several populations of invasive plants are present in the Green Mountain project area (Table 54). Plant species such as: St. John's Wort (*Hypericum perforatum*), Scotch Broom (*Cystisus scoparius*), Tansy Ragwort (*Senecio vulgaris*), Bull thistle (*Cirsium vulgare*), Himalayan Blackberry (*Rubus armenicus*), cutleaf blackberry (*Rubus lacinatus*), and spotted knapweed (*Centaurea strobe*) are found along roads within and adjacent to the project area. With the exception of spotted knapweed, these weeds are considered "established invaders" because they are commonly found on adjacent properties and throughout the Willamette National Forest. Spotted knapweed and false brome (*Brachypodium sylvaticum*) are considered "new invader" species because their distributions are limited in the Forest and they have greater potential for spread.

In the Green Mountain project area false brome and other known species are mainly found on road shoulders, but also occur in some proposed harvest units. Similar management actions in adjacent watersheds have contributed to the establishment of this plant in particular. Based on post-harvest observations of these other stands, it is assumed that false brome would likely become established in all suitable habitats adjacent to established populations in the Green Mountain project area. Best Management Practices, such as Early-Detection, Rapid-Response, equipment cleaning, and competitive seeding are effective at minimizing post-harvest effects on invasive plants.

It should be noted, grasses and forbs are the first plants to colonize early seral habitats, with shrubs and trees becoming established later as the stand matures. Gaps and other created openings attract wildlife looking for forage. Though less palatable than native forage, false brome is browsed, and then passed through manure. The seed can also get embedded in their fur. Most foraging wildlife species cover large areas, as such, there is potential to increase the range invasive plants, even with established Best Management Practices.

Table 54. Invasive Plants in the Green Mountain Project Area

Invasive Species	Proposed Unit
False Brome (*Brachypodium sylvaticum*)	110, 150, 420, 300, 880
Spotted Knapweed (*Centaurea strobe*)	100,830, 800, 5290, 5410
Herb Robert (*Geranium robertanium*)	150, 5440

Invasive Species	Proposed Unit
Deptford Pink (*Dianthus armeria*)	100, 1481, 1482, 1450, 5230, 5370, 5410, 5680
Himalayan Blackberry (*Rubus armenicus)*	290,400, 390, 840, 1490, 1861, 410
Cut-leaf Blackberry (*Rubus lacinatus*)	290,400, 390, 840, 1490, 1861, 410

3.6.10 Environmental Consequences – Invasive Plants

Direct and Indirect Effects

Alternative 1 – No Action

There would be no effects to invasive plants with this alternative. Invasive plant populations would likely continue to spread at the current rate. Selecting this alternative would not create disturbed areas as a result of harvest, hauling, or fuel treatment activities.

Since the No-Action alternative does not propose thinning, temporary road construction, or fuel treatments it would not create additional suitable habitat in terms of soil disturbance, temporary roads, gaps, or landings. However, natural vectors (i.e. wildlife and wind) would continue to spread invasive plants. New and potential invader plant populations documented in the Green Mountain project area would remain highest priority in receiving treatment and monitoring, as determined by the District Botanist.

Alternative 2 and 3

In most cases, invasive plant effects in this range can be minimized through proper inventory and project design. Since the majority of the Forest's invasive plant infestations occur along road shoulders, road maintenance and skid trails in harvest units represent a particular risk for inadvertently spreading weeds. Activities such as grading, brushing and mowing, culvert upgrades, and ditch cleaning can spread invasive plant species from one watershed to another.

Ground disturbance and habitat modification from project implementation would have an effect on invasive plants. It provides suitable conditions for invasive plants to establish or out-compete early pioneer native species. This effect would be observed for approximately 3-5 years on temporary roads and created openings (landings and gaps). This effect would diminish over time as native vegetation establishes and out-competes the non-native species. Often there are many other connected activities, such as road improvements and slash treatment that have a presence on the landscape and result in some degree of ground disturbance.

Based on the observed response of false brome to management in similar timber types, it is likely Alternative 2 could eventually spread false brome into an additional 320 acres early seral habitat (gaps) above and beyond the commercial thinning acres. This is also in addition to 324 acres regeneration harvest. Regeneration harvest will leave approximately 20 trees per acre depending on land allocation and will result in larger swaths of available ground for false brome establishment. False brome is known to establish along disturbed margins and spreads into adjacent habitats, invading successfully under a range of environmental conditions including shade and high nutrients (Holmes, et al. 2008).

It is possible that the 324 acres of regeneration harvest and gaps proposed under Alternative 2 would become likely infested. In order to mitigate the effect ground disturbance would have on invasive plants, temporary roads and landings would be re-vegetated using native grass seed. Off-road machinery would be washed prior to accessing and departing sale areas to mitigate the potential of vectoring invasive plant propagules. Rock sources used in temporary road construction would be free of invasive plants and approved by the road engineers and the District Botanist.

By comparison, Alternative 2 proposes to harvest more acres and modify more habitat in the Green Mountain project area than Alternative 3. Therefore Alternative 2 carries a higher risk of creating new habitat for weed invasion.

Cumulative Effects

The cumulative effects analysis area for invasive plants is the Green Mountain project area because it addresses known distribution of invasive plants and likely travel routes for the proposed project. The invasive plants found in the project area are shade-intolerant and generally confined to roadsides and open areas, with the exception of false brome which in known to occur in some proposed harvest units.

The Green Mountain project proposes 4,398 acres of timber harvest. Past management action which has contributed to the current invasive plant condition, with approximately 6,103 acres of timber being harvested from 1990 through the present. This includes implementation of projects analyzed in Hartz Thin, Cascade Thin, and the Road 19 Danger Tree salvage project. Temporary roads were constructed with these projects but they were re-vegetated and decommissioned after the activities were completed. Decommissioning and re-vegetation post-harvest was done to mitigate the effect of temporary roads by prohibiting vehicular access and establishing competing vegetation. Based on plant observations in similar habitats, native vegetation generally returns to a previously disturbed area within 2-5 years. Competitive seeding reduces the amount of resources available to invasive plants and the amount of time it would take for native plants to colonize a site.

Timber harvest is the greatest contributor in this project to cumulative impacts on invasive plant habitat just as it does to fungi habitat. Alternative 2 proposes 4,398 acres and Alternative 3 proposes 3,957 acres of harvest; while approximately 6,200 acres have been managed in the past. Alternative 2 would increase potential cumulative effects to invasive plant by approximately 71%, while Alternative 3 would increase potential effects by nearly 64%. Therefore, Alternative 2 carries a higher risk of cumulative effects to invasive plants.

However, approximately 50% of these cumulative impacts can be mitigated through proper implementation of the design features included in Chapter 2, which includes a number of best management practices such as equipment cleaning, using weed-free rock, minimizing soil disturbance, and competitive seeding of temporary spurs and landings.

3.7 Heritage

3.7.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Heritage Resources includes the units proposed for treatment, road construction, landings, and hazardous fuel activities within the Green Mountain Project. All of these ground disturbing activities have the potential to affect the integrity of cultural resources. An archaeological survey of the Green Mountain project was conducted in order to comply with Section 106 of the National Historic Preservation Act (NHPA) and other relevant laws and regulations. A systematic surface pedestrian search is the principal manner for implementing the mandated goals.

3.7.2 Assessment Methodology

The field survey of Green Mountain project area was performed by eight crew members, utilized on different days, from May 18 through August 18, 2011 with late September follow-up visits to proposed road/landing locations May 29 through August 16, 2012. Pedestrian transects spaced at 15 to 20 meter intervals followed a specific orientation based on factors that included the shapes of units and landforms and the possible presence of historic, Indian or Euro-American travel routes. One-by-one meter shovel scrapes made with entrenching tools exposed mineral soil every 20 to 30 meters in areas where dense vegetation limited ground visibility. Bearing orientations were followed to the best of abilities, but adjustments in orientation, spacing intervals, and shovel scrape spacing were made in order to avoid dangerous or unreasonable conditions (e.g., exceptionally steep slopes or impenetrable vegetation). A total of 2,895 acres were surveyed consisting of 2,297 high probability acres and 598 low probability acres.

3.7.3 Affected Environment

There are 31 recorded cultural sites within the Green Mountain project area that are considered eligible or potentially eligible to the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine their eligibility to the NRHP. The proposed Green Mountain Project has the potential to affect nine of the thirty-one cultural sites , 06180100156, -177, -185, -240, -251, -265, -292, -692, -699, -714.

The prehistory and history of the McKenzie River drainage have previously been summarized in the Cultural Resource Overview for the Willamette National Forest, Western Oregon (Minor and Pecor 1977) the ten-year update of the above overview (Minor 1987), Prehistory and History of B. L. M. Lands in West-Central Oregon: A Cultural Resource Overview (Minor, Beckman and Toepel 1981) Archaeology of Oregon (2nd Edition) (Aikens 1986), McKenzie River Valley History (Williams 1988), Prehistoric Land-Use Patterns In the North Santiam Subbasin on the Western Slopes of the Oregon Cascade Range (Kelly 2001); Prehistoric Land Use Patterns In The Central Oregon Cascade Range (Snyder 1987) and numerous other publications. These documents provide adequate detail of ethnographic and historic background for this report.

Cultural History

Ethnographic research indicates that highly mobile prehistoric and early historic Indian groups, probably the Molala, Kalapuya, and their ancestors used the western Cascade Mountains for the main purposes of seasonal hunting, fishing, and plant gathering. Ethnographic evidence also suggests that the Molala Indians were indigenous to the area and lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. The Molala are linguistically related to Willamette Valley groups, but are thought to be composed of montane-based bands who were living in the western Oregon Cascades during the historic period.

Most of what is known of the Molala comes from two of the three subgroups into which they are generally split: the Northern Molala located in the vicinity of Mount Hood’s drainage systems and the Southern Molala located west of the Klamath Lake area. Little is known of the third group, referred to as the Upper Santiam/Santiam band of Molala, who are thought to have inhabited Linn and Lane counties in the areas between the northern and southern groups. The Molala are also often culturally grouped with the Kalapuya who were based in the Willamette Valley, but probably made seasonal forays to the Cascades for large game and berries.

The first recorded contact between the Indians and European trappers and settlers came in 1812 when members of the Pacific Fur Company under the leadership of Donald McKenzie (for whom the river and valley are named) entered the area (Williams 1988). Unfortunately, Indian contact with trappers, missionaries, military expeditions and settlers also brought them into contact with European diseases such as smallpox and influenza, which decimated their populations.

By the mid -1800s many of the remaining Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molala Treaties of 1855. Other Molala shifted to the Siletz Reservation along the Oregon coast, the Klamath Reservation to the south and to the Warm Springs Reservation in eastern Oregon where they were absorbed into the Confederated Tribes of Warm Springs.

Pre-contact Indian use in the area is reflected in the cultural material they left behind including chipped obsidian lithic scatters and obsidian lithic isolates, representing tool use, modification, or manufacture related to hunting and gathering. These sites are protected through avoidance from project activities.

Historic use of the project area appears mainly in the form of trails which functioned as a part of the administrative and communication network in the early days of the Forest Service. During the Civilian Conservation Corps (CCC) era from 1930-1942, a workforce composed of young men maintained miles of trails including: Augusta, Chucksney, Grasshopper, Hiyu Ridge, Roaring Ridge and Indian Ridge trails. The CCC also constructed the Box Canyon Guard Station, the Box Canyon Road along the north bank of the South Fork and established small campgrounds at Homestead Forest Camp and Frissell Crossing. However, no permanent structures, such as shelters or fireplaces were constructed at these early Forest Service recreation sites.

3.7.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Implementation of the no action alternative would not directly nor indirectly affect cultural resources since there would be no change to the integrity of cultural resource sites.

Alternative 2

Implementation of Alternative 2 would result in ground disturbance on 137 miles of road maintenance on haul routes, .5 miles of new road construction; 9.5 miles of temporary new road construction; and 2630 acres of skyline harvest, 178 acres of helicopter harvest and 749 acres of ground based harvest for a total timber harvest of 3557 acres. Post-harvest activities include 856 acres of underburning slash and associated fireline construction, 2701 acres of pile and burn slash and 421 acres of conifer tree planting. Timber harvest, new and temporary road construction, ground base and skyline yarding and post-harvest fuel treatment would be greater under this alternative producing an increased amount of ground disturbance. Ground disturbance can affect the surface and subsurface integrity of an archaeological site and thus its significance to the National Register of Historic Places.

Since appropriate and approved surveys and cultural site protection measures are already in place (see Design Measures Chapter 2), the potential direct effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action.

Therefore, contract clause BT6.24 must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during timber sale operations

Alternative 3

Implementation of Alternative 3 would result in ground disturbance on 17 less miles of road maintenance on haul routes, zero miles of new road construction; 9.5 miles of temporary new road construction; and 367 less acres of timber harvest. Post-harvest activities include 518 less acres of underburning slash and associated fireline construction, 151 more acres of pile and burn slash and 368 less acres of conifer tree planting.

Based on these numbers, Alternative 3 would result in less ground disturbance from harvest thinning activities, thus less potential for inadvertent damage to the integrity of cultural resources which were not discovered during initial survey. Since appropriate and approved surveys and cultural site protection measures are already in place (see Design Measures Chapter 2), the potential direct effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract clause BT6.24 must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during timber sale operations.

Therefore, no adverse effects are anticipated from either Alternative 2 or 3 due to the avoidance of known cultural resources and the application of timber sale contract clause BT6.24.

Cumulative Effects

Alternative 2 and 3

Previous impacts to the area have mainly included road construction, timber harvest activities and wildfires. Timber harvest and the associated road/landing building have been the primary recent activities shaping the landscape. There has been approximately 5,327 acres (11% of the project area) of harvest on federal grounds within the project area, and 87% of the treatments have been regeneration harvests. The earliest clear cut was harvested in the 1960’s. Some of these stands have since received thinning and some have not.

Over the last 100 to 300 years, the Green Mountain project area has been shaped by fire, both natural and as a result of aboriginal under-burning (Soil and Geology Report for Green Mountain, 2012). The fire records show that, from 1970 to 2009 alone, 266 fires have occurred within the project area (Mei Lin Lantz, assistant fire management officer, personal communication).

Some of the above activities exposed cultural sites and damaged the integrity of the known sites within the project area. Based on past archaeological excavation work, we do know that the extent of damage from timber sale harvest usually occurred at a depth of 20 to 40cm. Most of the timber sale harvest damage to cultural sites occurred during actions undertaken by the Forest Service prior to the President signing Executive Order 11593 and implementation of Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) (See Affected Environment). During this period prior to the mid to late 1970s, the Forest Service was not required to hire professional archaeologists to conduct cultural resource surveys. Thus few sites were known on the forest. If cultural sites are discovered during the current Green Mountain project then project activities would be halted until the archaeologist can determine the extent of the damage and determine further course of action if necessary.

Based on a review of the past, present and foreseeable projects listed in Appendix F, there are no additional cumulative effects anticipated to occur to the known cultural sites from any of the proposed actions under the Green Mountain Project since appropriate and approved surveys and cultural site protection measures are already in place for this project (see Design Features in Chapter 2).

3.8 Roads and Access

3.8.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Roads and Access includes the project activity units and the overall Green Mountain project area.

3.8.2 Affected Environment

The project area includes approximately 244.4 miles of existing roads. There are approximately 239.3 miles of Forest Service system roads and 5.1 miles of private roads in the project area. There are no State or Federal Highways or County roads within the project area boundary. The Forest Road system consists of approximately 22.8 miles of arterial road, 42.9 miles of collector roads and 173.6 miles of local roads.

In and near the Green Mountain project area past management activities have provided the current network of Forest Roads mainly from timber sales. The current system of roads provides access to the area for administration, fire protection, public recreation, and forest product utilization. Approximately 26.2 miles of road are asphalt surfaced, 182.6 miles are surfaced with crushed aggregate, 6.8 miles are surfaced with improved native material, and 28.8 miles are native surfaced. Approximately 197 miles of road within the project area are currently open to mixed motorized use. (MVUM 2013).

Oregon State Highway 126 is the primary transportation corridor serving the project area. Forest Road 19 is the primary transportation corridor serving the project area from Oregon State Highway 126 and is the only road classified as an arterial within the project area. Road 19, known as Aufderheide Drive, is a double-lane asphalt surfaced road and serves as a segment of the West Cascades National Scenic Byway. Roads 1927 (Augusta Creek), 1958 (Roaring River Ridge), 1964 (Elk Creek), 1980 (Hardy Creek), 1985 (Green Mountain) and 1986 (Rider Creek) are classified as collectors roads and provide the primary access to Road 19. These roads serve as major routes for fire and public access, silvicultural operations and haul routes for any commodity extraction activities along with important recreational access, for hunting, scenic driving, and dispersed recreation.

There are 118.6 miles of “key” forest roads identified in the Roads Analysis Report (USDA 2003) within the project area. The Roads Analysis Report identified a need for these roads for long-term management of the Forest, and for access to recreation opportunities, administrative sites, and private lands. They are the priority roads that are typically maintained for vehicular traffic but may or may not be open to vehicular traffic based on forest management objectives. These key roads provide the long-term transportation network necessary to meet forest management objectives.

There are currently 73.1 miles of forest system roads in the project area that are closed. These roads are closed by means of gates, berms, or other physical barriers implemented through road management, or naturally by vegetative growth or blown down timber, or by administrative order. There are approximately 8.0 miles of roads in the project area that have been decommissioned.

The current road system allows the Forest Service administrative access to conduct a wide variety of forest management and fire protection activities in the area. Specifically, the forest roads provide access to Army Corps of Engineer facilities, six developed Forest Service campgrounds, 3 group campgrounds, two cabin rentals, Terwilliger Hot Springs, various boat ramps, numerous trailheads, lakes, and various dispersed camping sites. These roads also allow access for firewood and special forest products gathering.

The road system receives maintenance in accordance with established road management objectives. Over the last decade, a limitation on road maintenance funds on the Forest has resulted in a backlog of maintenance work including road side brushing, drainage and ditch cleanout, and road surface repair on many of the key and secondary roads in the project area. Under Alternative 2 and 3, there are drainage improvements which would be implemented prior to commercial haul, to protect water quality. Many of the culverts on the roads are in poor condition or undersized, and are in need of replacement. Additional deferred maintenance is expected in the future unless maintenance budget funding is improved.

3.8.2 Environmental Consequences

Direct and Indirect Effects

Alternative 1

Alternative 1 would not change the use pattern of roads or correct existing road maintenance problems. Without treatment-related road maintenance, the existing budgetary trend makes it unlikely that funding would be available to support adequate road maintenance. Brush and tree re-growth and associated reduced visibility, debris on road, and surface irregularities from OHV and other traffic could eventually result in unsafe traveling conditions for public and administrative traffic, as well as increasing resource damage associated with localized erosion. There is currently a backlog of road maintenance and some local roads are impassible due to fallen trees or brush encroachment. Culverts that are not maintained because of impassible roads may plug and cause washouts with sediment reaching into major drainages.

Alternative 2 and Alternative 3

Road maintenance would occur on 130 miles of road with Alternative 2 and 115 miles with Alternative 3. Road maintenance would protect the existing road infrastructure, improve safety of the road, and decrease sedimentation on roads used for project implementation. Road maintenance may include roadside brushing, road surface blading, ditch and culvert drainage maintenance, culvert replacement, surface rocking, asphalt patching and/or the installation of drainage dips and waterbars which will result in the proper drainage and safe use of the roads (see Design Features in Chapter 2). Roadside brushing would increase sight distance and increase visibility for safer driving. There are miscellaneous segments of low standard road identified as potential haul routes throughout the project area that would require minor road width adjustments and road surface rehabilitation to support commercial haul.

Maintenance proposed with Alternative 2 and 3 may cause a temporary increase in sedimentation while the road maintenance work is being done (prior to treatments and associated road use), but would decrease the volume and velocity of water that carries sediments off roads afterwards. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts may increase sediment production until road surfaces and slopes stabilize, typically within approximately one to two seasons. Attention will be paid during road maintenance activities to minimize potential delivery to adjacent streams and Best Management Practices would be applied to prevent sedimentation to the greatest extent. Designated water sources for filling water tankers for surface blading, compaction and dust abatement operations would not significantly affect stream flows.

Alternative 2 would provide necessary road maintenance on haul routes and roads used for other treatment activities. This would reverse the trend of declining road conditions across an estimated 135 miles of road or approximately 55 percent of the project area's road system. Alternative 3 would provide necessary road maintenance on haul routes and roads used for other treatment activities. The maintenance performed would reverse the trend of declining road conditions across an estimated 115 miles of road or approximately 47 percent of the project area's road system. Alternative 3 would maintain less miles of road than Alternative 2 because it would have less haul routes associated with these activities. The use of fewer roads in the project area would continue the backlog of needed road maintenance activities. The miles of road open to public access in both alternatives would be reduced. Maintenance activities would cause some short-term delays or detours for road users while roadwork is being performed. All OHV use on roads currently open to mixed use would be restricted while treatment activities are taking place.

Alternative 2 and 3 would require the replacement of the Hardy Creek Bridge located on Road 1980204 to provide safe access for all project activities located across Hardy Creek. The original 61 foot native log stringer bridge was constructed in 1963, and has had repairs and upgrades made to different structural components throughout its life span. The bridge is in a current state of disrepair and no longer provides safe access and is currently closed. The current bridge would be replaced with steel or a pre stressed concrete bridge approximately 90 feet in length.

Alternative 2 would have approximately 10.3 miles and Alternative 3 would have approximately 8.6 miles of temporary roads built within the project area. Implementation of either action Alternative would result in a temporary increase of disturbance due to additional miles of temporary roads and increased traffic to access the treatment stands. Temporary roads would be removed once activities are completed and would not change road miles or access in the long term.

Portions of the original road system were constructed to accommodate large yarding towers that were used to log large tracts of land. Current thinning activity usually utilizes small, mobile, road-based yarders. Temporary spur road construction has been kept to a minimum in both action Alternatives, utilizing the existing transportation system, skid trails and previously disturbed areas wherever possible. New temporary roads would typically be located to use gentle slopes and minimize soil disturbance wherever possible.

All currently closed system roads that would be re-opened and utilized for timber haul (approximately 22 miles in Alternatives 2 and 3) would have maintenance performed prior to any haul. Upon the completion of project activities, these roads would then be physically blocked to traffic. All roads treated would be left in a hydrologically stable condition to drain properly and protect water quality. Future road maintenance costs would be reduced because roads would be re-closed to traffic and left with self-maintaining water drainage features.

Both action Alternatives 2 and 3 would implement approximately 26 miles of system road closures or decommissioning within the project area (Figures 28 and 29). These roads would be closed through placement of various types of barriers. Roads identified for storage treatments may include any of the following treatments as needed; closure by physical barrier, non-drivable water bars, removal of culverts from stream channels with fills of shallow to moderate depth, reduction of fill depth for culverts in deep fill locations. Stored roads would include minimal disturbance to the roadbed because they may need to be reopened in the future for various management activities, including timber harvest and fire suppression activities. Roads identified for decommissioning may include any of the following treatments described with road storage but may also include removal of culverts from stream channels in deep fills, slope recontouring, and sub-soiling. System roads are decommissioned when it is has been determined they are no longer needed to provide access for management activities, these roads are removed from the road system. Roads closed by gate would maintain administrative access.

Proposed road closures with gates or earth berms would decrease vehicular access (public, administrative and commercial), decrease the current effective open road density, reduce existing road erosion problems, and reduce road maintenance costs. Roads closed by the project would be left in a hydrologically stable condition to protect water quality. There would be fewer roads for public and administrative vehicle access for recreation, reforestation, fire and noxious weed control. Removing berms to access roads for fires suppression would take additional time and equipment.

Table 55 shows the proposed road activities associated with harvest and the miles for each alternative. Figures 28 and 29 illustrate the proposed road activities associated with harvest.

Table 55. Proposed Road Activities Associated with Harvest

Activities	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
New Road Construction	Miles	0	0	0
Temporary Road Construction	Miles	0	10.3	8.6
Roads Maintained	Miles	0	130	115
Road Decommissioning	Miles	0	2	2
Road Storage	Miles	0	21.1	21.1
Seasonal Road Closure Removed	Miles	0	6	6
Seasonal Road Closure Changed to Permanent Road Closure	Miles	0	3	3
Bridge Replacement (Hardy Creek)	-	No	Yes	Yes
Rock obtained from expanding existing quarries	Cubic Yards	0	15,000	15,000

Cumulative Effects

Past management actions have created 239.3 miles of Forest Service road system within the project area that require continuing road maintenance to provide adequate safe use and resource protection. Past budgets have resulted in maintenance rates that have led to a decline in road conditions across the project area. Alternatives 2 and 3 would provide necessary road maintenance on the haul routes and roads used for other treatment activities. Road maintenance and road closure treatments proposed under these alternatives would continue to improve the road system by reducing sedimentation increasing safety and reducing future maintenance costs.

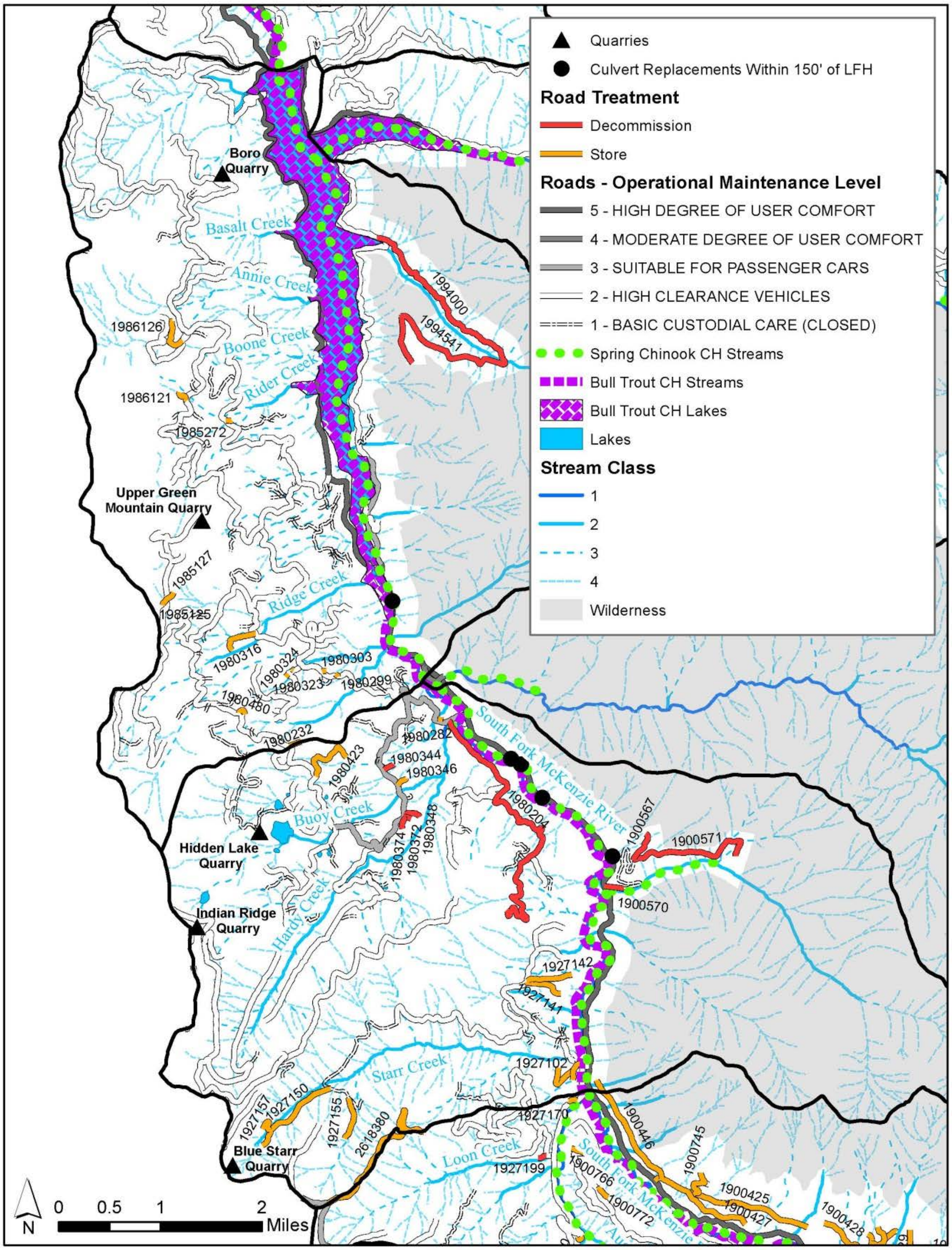


Figure 28. Proposed Road Activities Associated with Harvest (North)

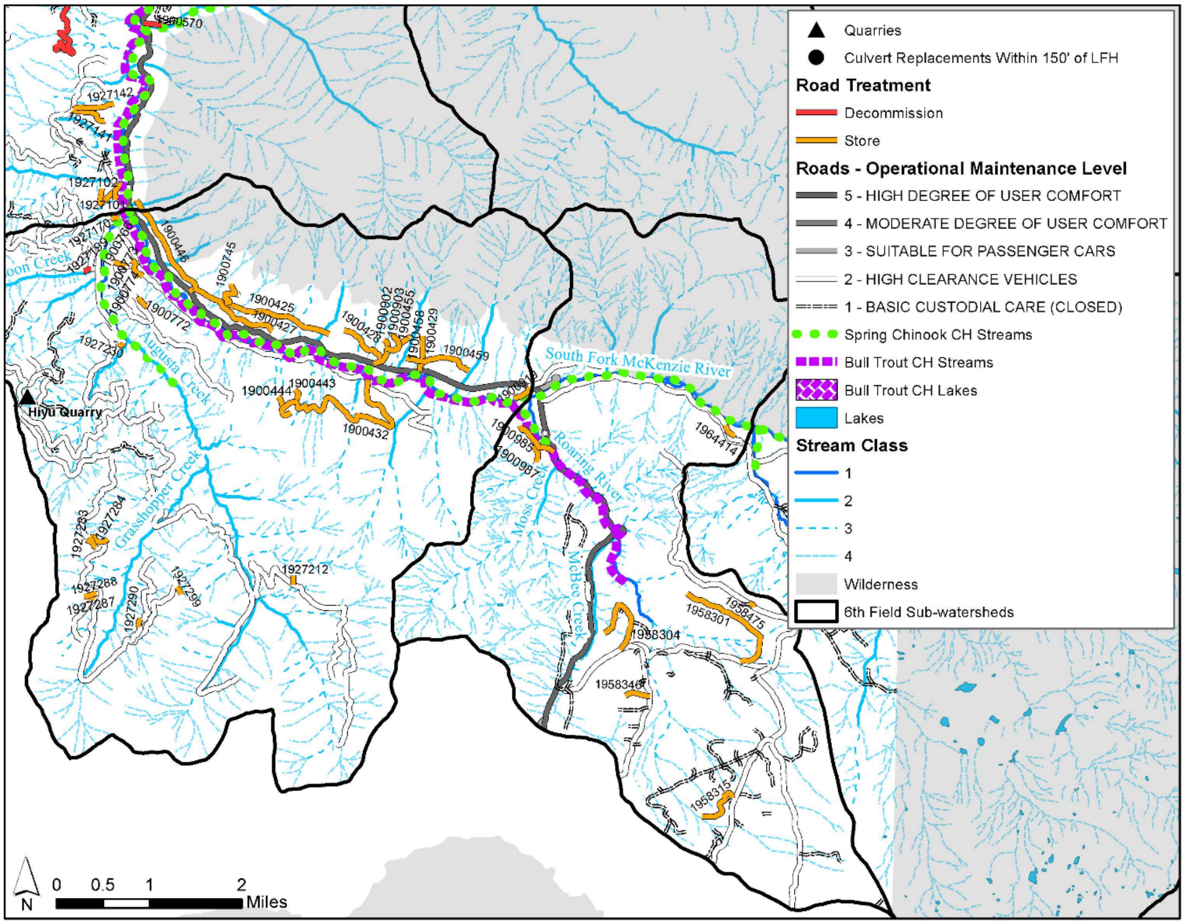


Figure 29. Proposed Road Activities Associated with Harvest (South)

3.9 Recreation

3.9.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects of the Green Mountain project on recreation are key recreational use corridors, travel routes, developed and dispersed recreation sites and trails within the Green Mountain project area.

3.9.2 Affected Environment

Visitor use in the project area is largely driven by seasonally directed activities and the area is popular for both developed and dispersed recreation including camping, hiking, horseback riding, scenic driving, fishing, bicycling, picnicking, berry picking, mushroom harvesting, hot spring soaking, viewing scenery, and hunting. Fishing, picnicking and camping along the South Fork of the McKenzie River are very popular activities. Cougar Reservoir supports recreational boating and fishing and Terwilliger (aka Cougar) Hot springs is a very popular day use area. An extensive trail system in the area supports a range of trail oriented activities including multi-day backpacking trips, day hiking, horseback riding and mountain biking. Numerous developed recreation facilities including campgrounds, day use areas, boat launches and rental cabins provide a wide array of developed recreation options for visitors.

The Oregon Omnibus Wild and Scenic Rivers Act of 1988 added segments of 40 rivers into the National Wild and Scenic Rivers System. It also designated seven rivers in Oregon eligible as National Study Rivers and called for their study in order to determine their suitability for inclusion into the National Wild and Scenic Rivers System. A 25.7 mile stretch of the South Fork of the McKenzie River is included as one of those rivers and is within the project area.

Forest Road 19, also known as the Robert Aufderheide Memorial Drive, is the primary road in the project area and is a designated portion of the West Cascades National Scenic Byway. National Scenic Byways are defined as areas with archeological, cultural, historic, natural, recreational and scenic qualities and are managed collaboratively to help recognize, preserve and enhance selected roads throughout the United States. The highway consists of paved roads which carve a path through scenic forests, the historic logging community of Westfir, the Constitution Grove, Box Canyon Guard Station, the Aufderheide Memorial, Cougar Reservoir and the McKenzie Highway. The route follows the Middle and North Forks of the Willamette River, up Box Canyon and down the South Fork and main fork of the McKenzie River. Forest Road 19 is a popular route for road biking enthusiasts and efforts are being made by a variety of stakeholder groups and local government agencies to promote this route as a road biking destination.

Developed Recreation

There are nine developed campgrounds in the project area including Cougar Crossing, Sunnyside, Slide Creek, French Pete, Red Diamond, Hard Rock, Frissell Crossing, Roaring River and Box Canyon Horse Camp. Echo and Slide Creek boat launches provide access to Cougar Reservoir and four day use areas, Terwilliger Hotsprings, Slide Creek, Cougar Crossing, and Echo/East Fork Trailhead provide access to trails, picnic sites, swimming holes and hotsprings. Two reservation system cabins; Box Canyon Guard Station and Indian Ridge Lookout are popular renovated historic Forest Service buildings. Three developed trail heads; French Pete, Echo/East Fork, and Rebel Rock offer restroom facilities, parking spurs and wilderness entry stations. Box Canyon Horse Camp provides equestrian facilities and there are a range of smaller trail heads that appeal to both hikers and equestrian users. Terwilliger Hotsprings is a very popular destination for hotsprings enthusiasts and is the highest grossing fee facility on the Willamette National Forest.

Dispersed Recreation

Dispersed recreation sites are places the public has historically used and continues to use for recreation and are not intensively managed. These sites range in frequency of use by season, and some high use sites may receive use several times per week or more during the summer. There are approximately 30 high use dispersed recreation sites in the project area that are accessible by vehicle and are often associated with short, spur roads that access the South Fork of the McKenzie River, Cougar Reservoir or Hidden Lake. In addition there are also many, less used dispersed sites, on the secondary road system. These sites are typically associated with hunting camps and are often located at the ends of forest roads or at access points into preferred hunting areas. Some dispersed recreation sites are located within a restricted use corridor where camping is prohibited by a special forest order.

Trails

There are approximately 91 miles of managed, non-motorized, multiple use trails within the project area. Several of these trails have developed trail heads with paved access roads and parking spurs, restrooms, garbage service, Wilderness entry stations and stock facilities. Rebel Rock and Olallie trails provide access to historic fire lookouts that are no longer in use. French Pete trail is popular for day hiking because it is relatively close to highway 126 and is well known for providing a scenic hike along a cascading creek among old growth forest. There are other non-system trails (unofficial user created trails that are not maintained by the Forest Service) in the project area. These trails are primarily found adjacent to Hidden Lake and in close proximity to developed campgrounds or along some portions of the South Fork of the McKenzie River.

Recreation Opportunity Spectrum (ROS)

Since the early 1980's, the Recreation Opportunity Spectrum (ROS) has been used as a framework for identifying, classifying, planning, and managing a range of recreation settings. Six distinct settings: urban, rural, roaded natural, semi-primitive motorized, semi-primitive non-motorized and primitive are defined using specific physical, managerial and social criteria. Two ROS classes; Roaded Natural and Roaded Modified have treatments proposed in the project area. Table 56 describes the desired condition for each class and proposed timber treatment acres. Figures 30 and 31 show the management areas and associated ROS classes geographically within the project area. For detailed information on ROS categories and criteria refer to the ROS User Guide, 1982 USDA Handbook, and the ROS Primer and Field Guide, 1990 USDA, R6-REC-021-90. For additional information on applications, refer to FSM 2311 and FSM 2330.

Table 56. Recreation Opportunity Spectrum (ROS) definitions.

ROS Class	Treatment Acres	Desired Condition for setting	Desired Condition for Activities
Roaded Modified	Alt 2: 3,889 Alt 3: 3,446	1) Opportunity to get away from others, but with easy access 2) Environment will appear substantially modified 3) Access and travel is conventional motorized vehicle 4)Shape and blend vegetation alterations, foreground should be natural appearing	Access for people with disabilities is a moderate challenge Rustic facilities provide some comfort and site protection Moderate site modification can occur
Roaded Natural	Alt 2: 530 Alt 3: 527	1) Opportunity to affiliate with others but with some chance for privacy 2) Some obvious control of users 3) Mostly natural appearing setting 4) Vegetation modification done to maintain desired visual characteristics	Access for people with disabilities is difficult No on site facilities except occasional signing site modification by users

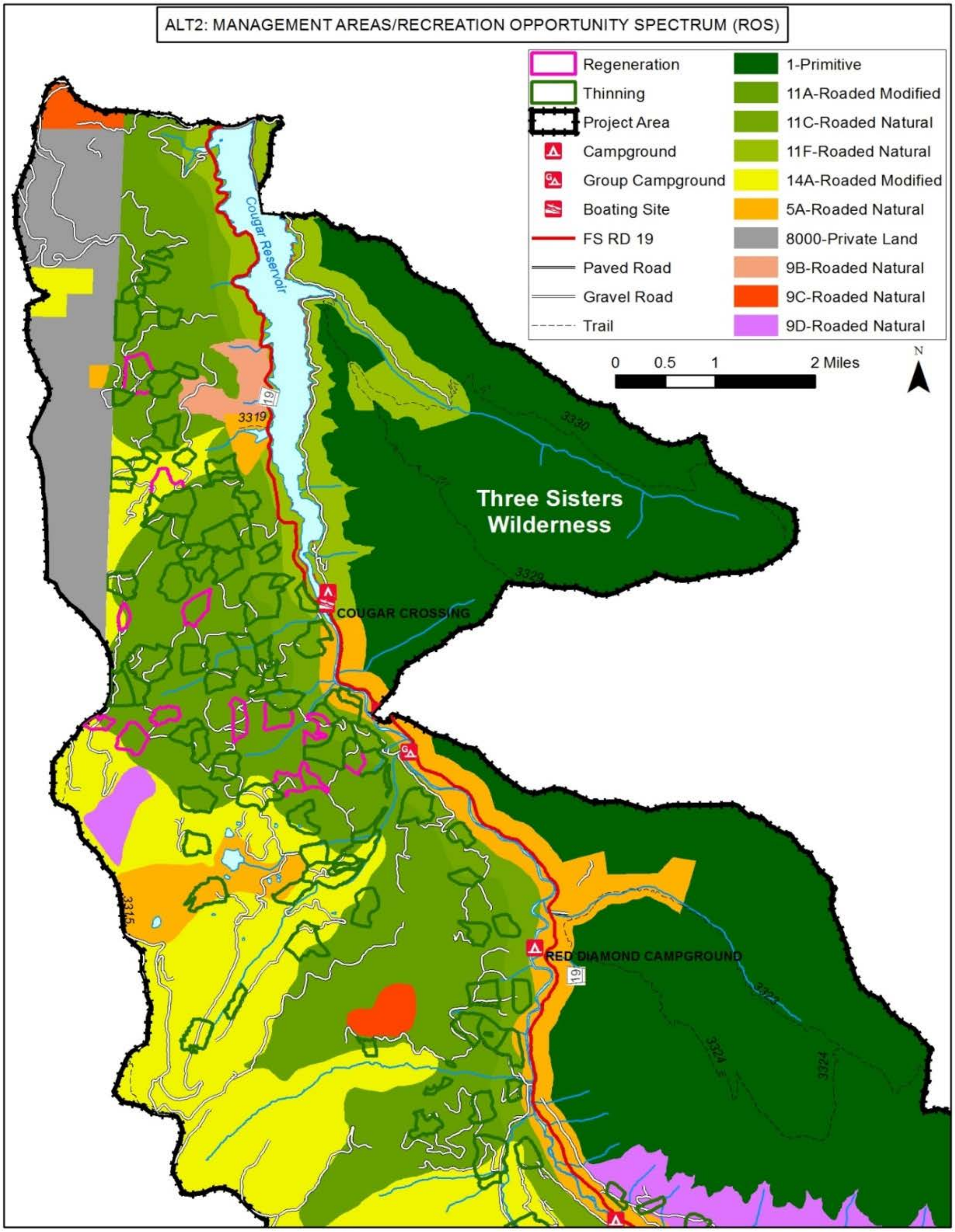


Figure 30. Management Areas and Associated ROS for Alternative 2 (North)

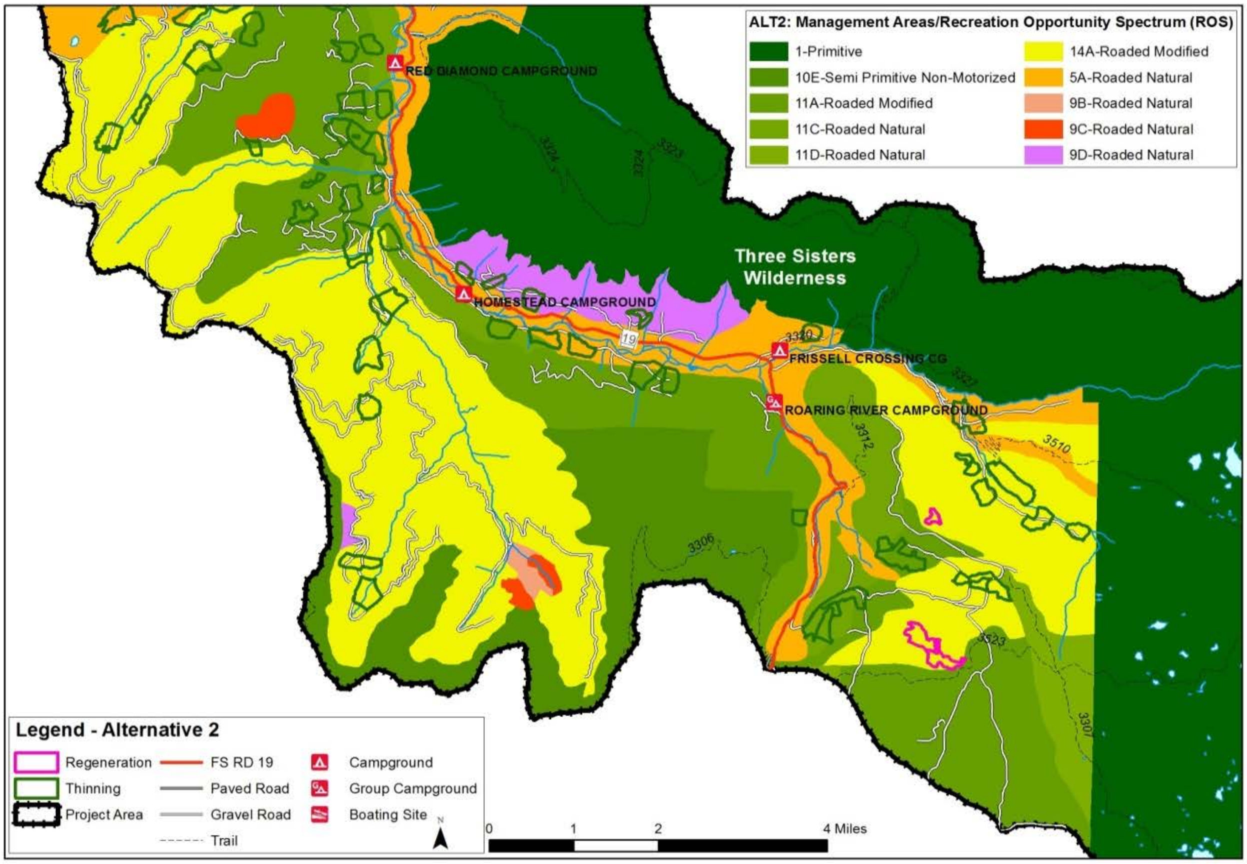


Figure 31. Management Areas and Associated ROS for Alternative 2 (South)

3.9.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No actions would occur with the implementation of Alternative 1. Potential benefits to scenic driving and access to dispersed camping opportunities due to improved road quality, opening closed roads and the replacement of the bridge on Forest Service Road 1980-204 would not occur.

Alternative 2 and 3

Developed Recreation

No significant direct impacts as a result of timber harvest activity are expected for developed recreation. Harvest activities will not take place in or directly adjacent to developed recreation areas and no developed recreation sites are expected to be closed during project implementation. Indirect impacts to developed recreation areas would be temporary and generally of short duration and may include dust and noise associated with hauling and timber harvesting activities. Dust abatement measures would be used as necessary for haul on gravel roads. Because the majority of developed recreation sites are accessed by Forest Road 19 which is paved, dust is unlikely to affect most recreation areas and the additional traffic associated with harvest activity will not be largely distinguishable nor add significantly to typical road use patterns by the public. Harvest activity generally takes place between the hours of 4AM-2PM due to high temperatures during the summer months further reducing the period when noise related impacts would occur. During the late summer and fall fire restrictions are typically implemented which requires all logging operations to stop at 1PM daily. Additionally, a .25 buffer around developed recreation sites will require no harvest activity between the hours of 10PM and 6AM. Most of the developed recreation sites in the project area are accessed by Forest Road 19 which will not be closed during project implementation and log hauling will not be permitted during weekends in the summer (mid-April through September).

Dispersed Recreation

Short term indirect impacts due to timber harvest such as dust and noise may affect some dispersed recreation in the project area, however no direct effects to any of the approximately 30 high use dispersed recreation sites are expected. Forest Road 19 is the primary access road for the majority of the high use dispersed recreation sites along the South Fork of the McKenzie River and this road will not be closed during harvest implementation and hauling will not be permitted on weekends during summer (mid-April through September). Forest Road 19 is paved and a popular travel route for the public and because of this noise associated with haul will not add significantly to impacts already associated with existing road use. Spur roads that access riverside dispersed recreation areas from Forest Road 19 will not be closed. Log hauling on secondary gravel roads may result in increased dust and noise for the few dispersed sites that are accessed by these roads. Signs will be posted at key road junctions to inform the public about the presence of log hauling operations.

Over the long term vehicle access to dispersed recreation areas will be improved due to maintenance of approximately 132 miles of road. Decommissioning of approximately 7.8 miles and storage of approximately 21.3 miles of road will eliminate vehicle access to dispersed sites in these road sections, however none of the proposed roads for decommissioning or storage are expected to affect any popular dispersed recreation sites. The seasonal closure of Forest Service Road 1900-430 and 1900-431 would be removed and would provide improved access to some dispersed camping and fishing opportunities along the southern banks of the South Fork of the McKenzie River.

A gate on Forest Service Road 1927-240 will be relocated further up the road allowing year round vehicle access to the upper 2.5 miles of this road. The bridge on Forest Road 1980-204 will be replaced allowing improved access to this road and associated dispersed recreation sites. These associated actions of the Green Mountain Project will improve access into areas that are often used by hunters or anglers.

Trails

Short term impacts during harvest activity such as noise and temporary trail closures and/or reroutes will occur and pre and post-harvest impacts such as boundary markers, marked trees, slash piles, stumps and skid trails will affect 1.25 miles of Elk Creek, South Fork and Frissell trails collectively or approximately 2% of the 91 total miles of trails in the project area (Figure 32). A Roaded Natural ROS category applies to trails and requires a mostly natural appearing physical setting with vegetation modifications done to maintain desired visual characteristics. Trails within Special Interest Areas (SIA's) are required to be managed to meet the standards specified in an implementation guide. The South Fork McKenzie River Implementation Guide applies to Elk Creek, Frissell Crossing and the South Fork Trails and provides goals for desired future condition for recreation, trails, scenery and timber management. Goals for desired future conditions include: SIA environment will appear minimally affected by management activities; maintain old growth character, avoid removal of old growth habitat; and avoid off-road proliferation and off-road vehicle use.

About .5 miles of the Elk Creek Trail, .5 miles of Frissell Crossing Trail and .25 miles of the South Fork Trail will be affected by timber treatments. These trails have class 3 designations requiring that activities within the trail corridor meet the physical setting for Roaded Natural ROS opportunities at a minimum. The forest plan further specifies that for trails passing through management areas with a more restrictive ROS class the more restrictive standard shall apply. In this case the ROS classification is the same as the applicable management area (5a Special Interest Area) that the trails pass through.

The primary direct effect of timber treatment activity on these trails will be the need to temporarily close or reroute hikers around portions of these trails during harvest treatment activity. Impacts such as noise and dust associated with helicopter hauling, timber harvest activities and truck hauling may be noticeable for hikers on trails that remain open in the vicinity of harvest activities. These impacts will be minimized due to a no haul requirement on weekends which is when the bulk of recreation use occurs.

Hikers on trails that pass through harvest units will notice marking associated with pre-sale preparation. During and after harvest activities slash piles, stumps and skid trails will be also be noticeable, however as vegetative recovery takes place (3-6 years), and post treatment mitigation measures are implemented, evidence of harvest activity will become largely unnoticeable. In the long term (6-10 years) the end result will be greater depth of views into the surrounding landscape due to decreased stand density, healthier and larger individual trees and less understory vegetation.

The proposed timber treatments adjacent to Elk Creek, South Fork Trail and Frissell Crossing Trail will meet applicable standards and guidelines specified in the forest plan for management area 5a and will be consistent with desired future conditions described in the South Fork McKenzie Implementation Guide. Design features such as a requirement to orient leave tree and other boundary markers away from trails, remove boundary markers after harvest activity and mitigate slash piles within 150ft. of trails have been established to protect trails in close proximity to harvest units. A recreation specialist will be integrated into the design and layout phase to further mitigate potential impacts to the trail tread, scenery and parking areas prior to project implementation and to make recommendations about ways to improve resource conditions where impacts have expanded at trailhead areas due to uncontrolled vehicle parking

To inform the public about potential disruptions to trail access information about project activities that will be posted at developed recreation sites, trail heads and information stations along Forest Road19 and at the district office. The Willamette National Forest website will also be updated with this information.

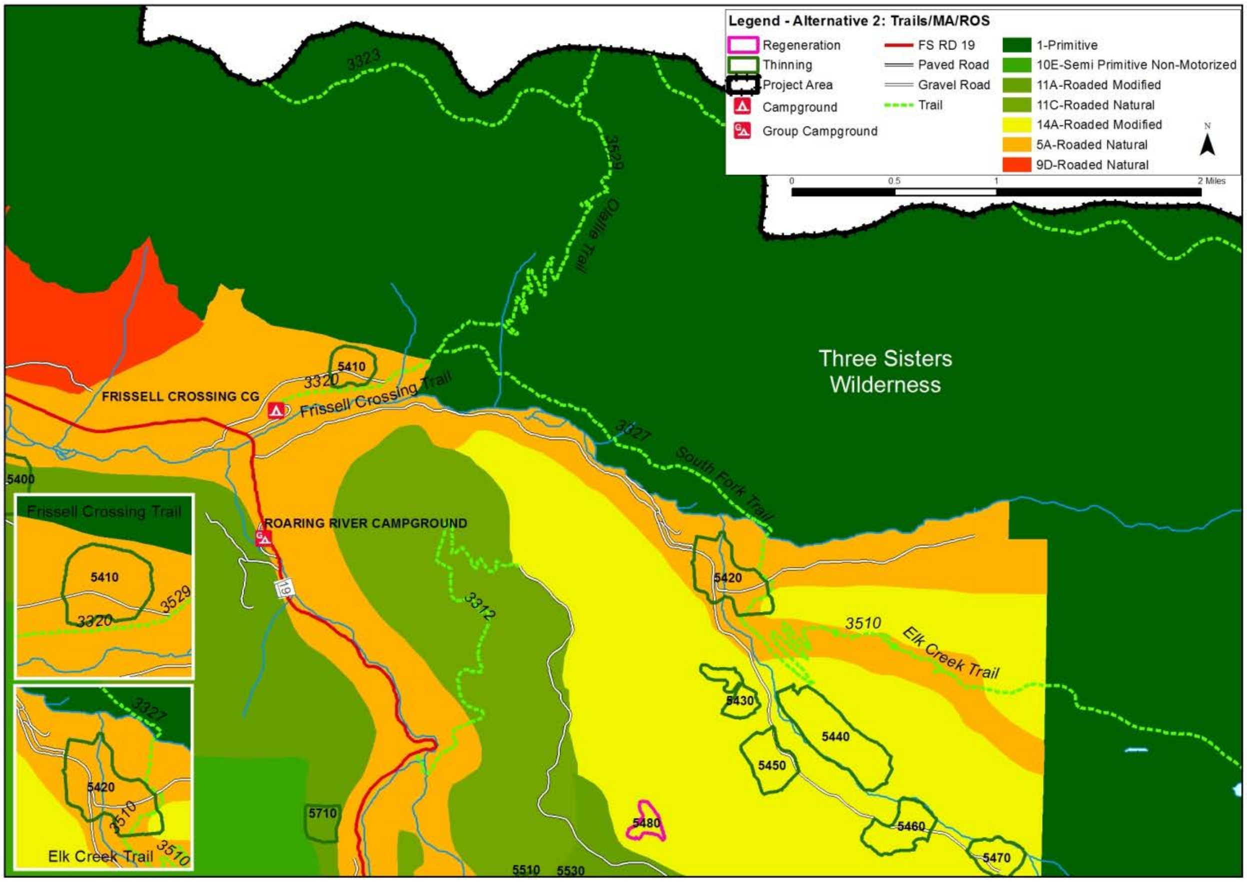


Figure 32. Affected Trails in the Project Area –Alternative 2

Cumulative Effects

Alternative 2 and 3

There are two ongoing timber sale projects in the Green Mountain project area. The Forest Road 19 Salvage Project, and the Hartz Reoffer Project. These projects are not expected to add cumulatively to impacts to recreation because the Forest Road 10 Salvage Project and Hartz Reoffer Project will not directly impact trails, dispersed or developed recreation sites and indirect impacts such as noise and/or dust associated with these projects will not add significantly to the indirect effects to recreation associated with the Green Mountain Project.

There are approximately 244 miles of Forest system roads in the project area, and approximately 73 miles have been closed with either gates, berms, or other structures in the past. Approximately eight miles of roads have been decommissioned in the past. Road maintenance activities will continue and may include felling danger trees, clearing and grubbing, replacing drainage structures, asphalt pavement patching, repairing holes in the roadbed, reconstructing ditches, and placement of aggregate surfacing on many of the primary and secondary roads in the project area.

Trail maintenance will continue to ensure trails are open for public use. Possible closure of some underutilized trails may take place in the foreseeable future. Recreation facility maintenance at developed recreation sites will continue. Conversion of the former Homestead Campground into a fish release site and day use interpretive area took place in 2013 and additional work at this site will continue. No new developed recreation facilities are planned for the reasonably foreseeable future. Increased use trends due to persistent promotion of the area by various private entities and by local, state and county government programs may increase use at developed and dispersed recreation sites and trails.

Dispersed use particularly adjacent to the South Fork of the McKenzie River, Cougar Reservoir and Hidden Lake area may increase due to continued promotion of the area. Many of these sites will continue to be managed as part of the Respect the River program and additional sites may be added in the future. Efforts to curtail impacts associated with long term residency on National Forest Lands have been implemented in the area in the form of a forest order that prohibits camping and in the future this order could be amended or expanded if deemed necessary to protect natural resources.

An effort is underway to identify Forest Road 19 as a state scenic bikeway by local governments and non-government organizations. This may increase use of the road and associated recreation facilities along this road corridor.

Some overlap in time and space with the specific projects already underway and potentially with reasonably foreseeable project work primarily related to trails are recognized, however there are no significant additional cumulative effects anticipated for recreation resources related to implementation of the Green Mountain project.

3.10 Scenic Quality

3.10.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for scenic quality is the Green Mountain project area and associated viewsheds which are composed of five 6th field watersheds. These watersheds are: South Fork McKenzie River/Cougar Reservoir, Rebel Creek, Augusta Creek, Roaring River and Elk Creek. Natural and human caused disturbances or modifications including fire, disease, timber harvest, fire suppression and roads are visible within and adjacent to the project area.

3.10.2 Methodology

The analysis methods used to evaluate the effects of the alternatives on scenery were based on a review of the Forest Plan for consistency with applicable standards and guidelines and the Scenery Management System (SMS) handbook. Field reviews of proposed harvest units from key viewpoints in conjunction with GIS geo-spatial mapping and a digital perspective analysis tool using Google Earth was used to determine design features, mitigations and evaluate project effects on scenic quality.

3.10.2 Affected Environment

Existing Landscape

The landscape of the proposed Green Mountain project area is the landscape setting of the South Fork of the McKenzie River within the higher Western Cascades.

The Western Cascades landscape is a characteristic type of northwest American landscape. It is,

> “characterized by a general conformity in ridge crests separated by deep valleys with moderately steep, highly dissected, side slopes. In the southern portion (here) of this

> type, the major valleys are V-shaped. Glacial features are evident, but not pronounced throughout the area. Some rock cliffs and rock outcrops exist.
>
> Vegetation is characterized by dense stands of large trees including western hemlock, Douglas fir, grand fir and subalpine fir. Most areas have a continuous cover of over story and understory vegetation. Deciduous species of alder and maple are often intermixed along drainages. Some meadows are found in both lower and upper elevations.
>
> Water bodies are abundant in the northern portion of the area, but occur less frequently in the southern portion. They consist of marshes, ponds, lakes, streams and major rivers, most of which drain into the Willamette basin.
>
> A wide variety of rock formations exist in the area, but most are hidden by the dense vegetation cover. Some extensive bare rock ridges and volcanic plugs stand out above the vegetation and old volcanic lava flows are sparsely vegetated. "   (Pollock ,1981.)

The river is central to the landscape setting here, and central within the length of the proposed project area. The High Cascades are nearby to the east, and the upper river and creeks that flow into the Green Mountain area have a high Cascades character - of fast, cold mountain streams - a reminder of the high mountains nearby. The Green Mountain land area connects the high Cascades to the lower valley, is tied to the larger Willamette Valley in its land form, as part of the larger river and valley formation of the Mckenzie and Willamette.

The forest is nearly continuous over the landscape here within the Green Mountain area. Distinctive in the landscape are the forms of ridgelines, close views of rushing water and pools, large conifer trees viewed close at hand, leafy creek and riverside vegetation, seasonal changes such as fall color at roadside and high on the ridges, high parklike grassy spaces with scattered trees. The landscape has distinct character areas related to elevation and land formation and associated cultural features. As one travels the corridor the landscape setting is more primitive in character and more towards alpine in the upper elevations. Here is a description of the character areas a person sees traveling through the area following the main river –creek corridor. The roadside landscape characterized represents a broader landscape seen along that portion of the corridor.

Previous modifications of the Green Mountain landscape have included road construction, logging, and reservoir construction. The dam and created reservoir are within landscape views of the primitive Wilderness setting to the east and some of the natural river setting to the south. Large scale modifications include the modified appearance of the water with a modified edge – a cleared band – which extends a straight line through the setting, cut rock face to the east, constructed dam facilities.

Viewsheds

Viewsheds are characterized as those visible areas near important travel corridors where viewing scenery is an important component of the visitor experience. Running through the project area are 91 miles of non-motorized trails and numerous primary and secondary roads. Forest Road 19, also known as the Robert Aufderheide Memorial Drive is a part of the West Cascades National Scenic Byway and is the primary travel route for visitors in the project area. National Scenic Byways are areas with one or more archeological, cultural, historic, natural, recreational and scenic qualities and are managed collaboratively to recognize, preserve and enhance selected roads throughout the United States. Forest Road 19 is a paved road which carves a path through scenic forests and accesses the historic logging community of Westfir, the Constitution Old Growth Grove, Box Canyon Guard Station, the Aufderheide Memorial and Cougar Reservoir. The route follows the North Fork Middle Fork of the Willamette River, up to Box Canyon and down the South Fork and main fork of the McKenzie River to the junction of Highway 126. A number of interpretive sites are located along the Aufderheide Memorial Drive as well as numerous campgrounds, dispersed camping areas, trail heads, boat launches and day use areas. Box Canyon Guard Station and Indian Ridge Lookout are renovated, re-purposed historic buildings that can be rented by the public.

Two Special Interest Areas (SIAs) have timber harvest treatments proposed within them in the project area. The South Fork McKenzie SIA is recognized for its exceptional scenic, recreational, hydrological and biological characteristics. The Hidden/Lulu Lake SIA is a popular destination for fishing, non-motorized boating, and sun-bathing and is recognized for its unique natural setting. Special Interest Areas are land allocations designated in the 1990 Willamette National Forest Land and Resource Management Plan because of special qualities, such as cultural, historic, geologic, botanical or other values. Scenery for both of these SIA's have been analyzed separately in the SIA chapter of this document.

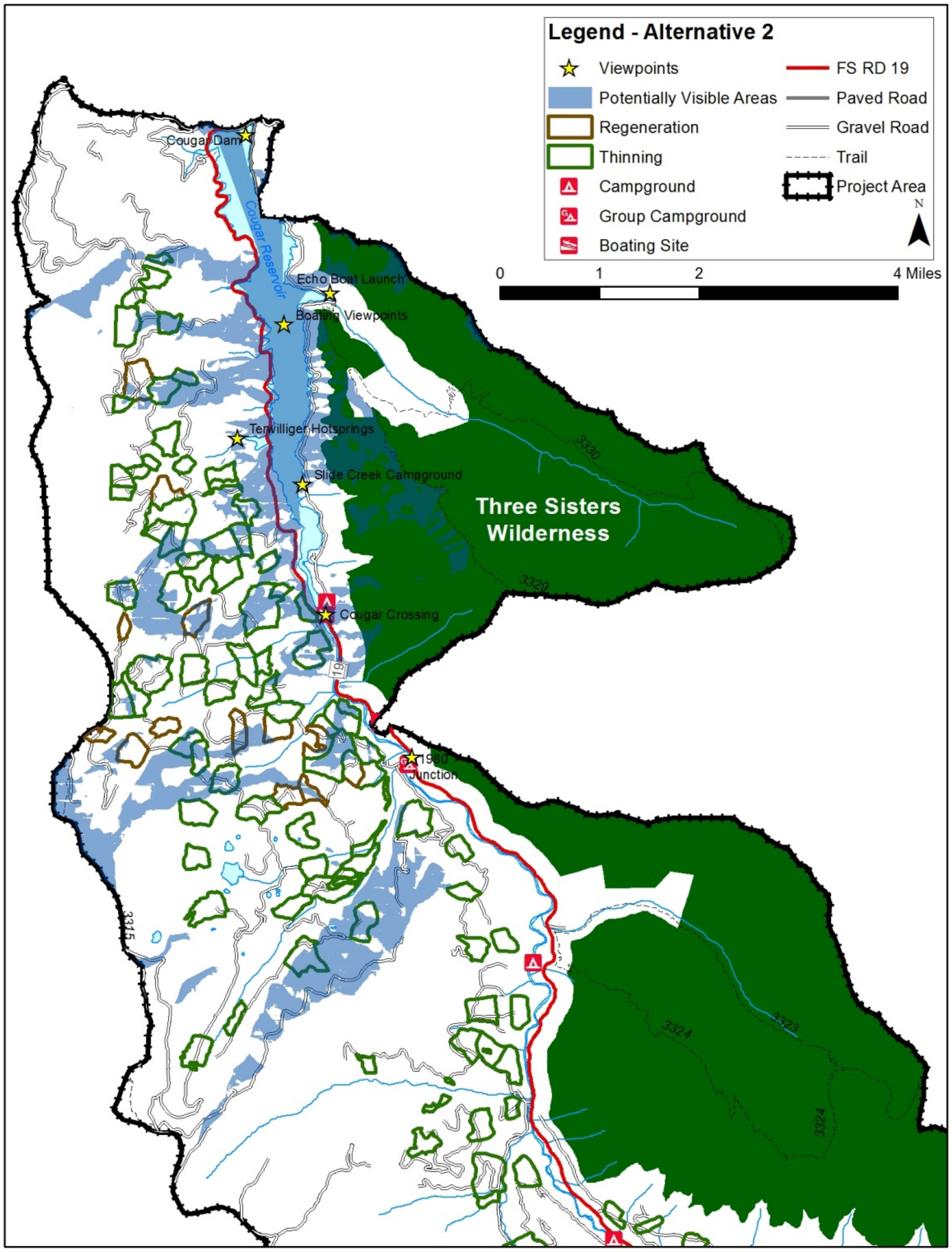


Figure 33. Potentially Visible Areas and Viewpoints within the Green Mountain Project Area

Visual Management System (VMS) and Scenery Management System (SMS)

The Visual Management System (VMS) was used to inventory and analyze aesthetic values on National Forest Lands until it was replaced by the Scenery Management System (SMS). The SMS evolved from the VMS and differs in that it has been expanded to reflect updated research findings. The current Land and Resource Management Plan for the Willamette National Forest remains tiered to the VMS system.

For the purposes of this analysis both VMS and SMS terminologies have been referenced and used together to retain consistency with the forest plan while recognizing changes in systems used for analyzing scenery.

Landscape visibility is a function of many essential, interconnected considerations including the following: 1) context of viewers, 2) duration of view, 3) degree of discernable detail, 4) seasonal variations and 5) number of viewers. Existing travel ways and use areas (viewpoints) were identified and classified in order to determine which existing observer positions to use in the landscape visibility analysis. The viewpoints analyzed for this project were; Cougar Dam, Terwilliger Hotsprings, Echo Day Use Area, Cougar Crossing Campground, Slide Creek Campground, the junction of Forest Road 19 and Forest Road 1980 and several points from the surface waters of Cougar Reservoir (Figure 33. Effects on scenery from these viewpoints were analyzed according to viewing distance classifications described in the SMS handbook. These distances are:

- Immediate Foreground (0-300ft)
- Foreground (300ft-.5mile)
- Middleground (.5mile-4miles)
- Background (4miles-horizon)

The Forest Plan establishes VQO categories (VMS) to describe the degrees of acceptable alteration of the natural landscape when considering timber stand management (Forest Plan FEIS, 1990). The five VQO and corresponding SMS categories are provided below in bold type in Table 57 as well as definitions. Table 58 shows proposed timber treatment aces and associated management area designation and VQO's.

Table 57. Visual Quality Objectives

Visual Quality Objectives (VQO's) and Corresponding SMS Categories
VQO-Preservation/SMS-Very High: Provides for ecological change only (VMS). Landscape character is intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level (SMS).
VQO-Retention/SMS-High: In general, human activities are not evident to the casual forest visitor (VMS). Landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so completely that and at such a scale that they are not evident (SMS).
VQO-Partial Retention/SMS-Moderate: In general, human activities may be evident but must remain subordinate to the characteristic landscape (VMS). Landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed (SMS).
VQO-Modification/SMS-Low: Human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture, and appear as natural occurrence when viewed in foreground or middle-ground distances. Landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.
VQO-Maximum Modification/SMS-Very Low: Human activity may dominate the characteristic landscape but should not appear as a natural occurrence when viewed as background. Landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character.

Table 58. Visual Quality Objective Acres in Project

Management Allocation	Visual Quality Objective (VQO)	Acres in Project Area	Acres in Alternative 2 Treatment Units	Acres in Alternative 3 Treatment Units
Special Interest Areas– (MA 5A)	Retention	5,744	265	265
Wildlife Habitat – Special Areas (MA 9D)	Retention	1,475	73	73
Matrix -(MA14A/MA11A)	Scenic Modification Middleground	11,062	1,387	1,245
Matrix -(MA14A/MA11C)	Scenic Partial Retention Middleground	2,800	541	426
Matrix -(MA14A/MA11D)	Scenic Partial Retention Foreground	889	3	0
Matrix -(MA14A/MA11F)	Scenic Retention Foreground	71	3	3
Matrix (MA 14A)	Max Modification	15,323	1,019	871
Riparian Reserves (MA 15)[1]		65,570	1,786	1,764
Adaptive Management Reserve (MA 17)	Scenic Modification Middleground 11A	2,975	788	755
Adaptive Management Reserve (MA 17)	Scenic Partial Retention Middleground 11C	684	151	151
Adaptive Management Reserve (MA 17)	Scenic Retention Foreground 11F	1,264	19	19
Adaptive Management Reserve (MA 17)	Max Modification 14A	615	152	149
	Total	**99,051**	**4,398**	**3,957**

1 – Riparian Reserves overlay other land allocations and are therefore not included in the Total Land Allocations

3.10.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No timber harvest treatment would occur with the implementation of Alternative 1. All visually sensitive Management Areas would remain consistent with Forest Plan standards and guidelines, and VQO's would be maintained. Alternative 1 would have no direct, indirect or cumulative effects on scenic quality in the project area. Potential benefits to scenery such as increased depth of view into the landscape along sections of trails and forest roads would not be realized under this alternative.

Alternative 2

Driving

Forest Road 19 (Aufderheide Drive) is part of the West Cascades National Scenic Byway and is a major travel route in the project area. Viewing scenery is a key component of the visitor experience for travelers on this route. While driving and viewing the landscape from Forest Road 19 some breaks in the forest along the road may provide short duration views (several seconds) of a few thinning harvest units in the project area. Because these units are thinning and not regeneration treatments, and are only intermittently visible at longer viewing distances, evidence of timber harvest will be largely unnoticeable to the casual forest visitor. Additionally, these units will be in Management Area 11a which has a VQO of Modification-Middleground. This VQO requires that scenery be managed for a modest level of scenic quality where management activities may dominate the natural surroundings but must borrow from elements of the original landscape. Thinning treatments within this VQO class as viewed from Forest Road 19 will meet this standard and guideline. Proposed timber harvest units in management areas with more restrictive VQO classes of Retention and Partial-Retention that require a more natural scenic setting will not be visible from Forest Road 19 in the project area.

Secondary roads in the project area primarily provide access to developed and dispersed recreation sites and to preferred hunting areas or places where gathering forest products is common. Secondary forest roads are not considered major travel routes and therefor scenery is not required to be analyzed to the degree that is for major travel routes and developed recreation sites. For those visitors driving on secondary roads that pass through or by thinning treatments, short-term effects to visual quality would be limited to pre-sale marking, exposed stumps from harvested trees, less dense forest stands, slash piles and possibly dust from logging trucks on unpaved forest roads. Long-term effects would include fewer exposed stumps as vegetation regrows (3-6 years after treatment) and greater increases in crowns and diameters of residual trees. Thinning treatments would accelerate forest stand development toward a more natural range of conditions and provide greater depths of view into the forest.

Regeneration harvest units will not be visible from Forest Road 19 or from developed recreation sites but will be visible from a variety of locations from secondary roads. Regeneration harvest would occur in 16 units for a total of 324 acres in the proposed alternative. For those visitors driving secondary roads through or near regeneration harvest units there would be a noticeable change in forest texture when passing through these areas. These treatments will be mostly constrained to management area 14a or 11a which provide for a modest level of scenic quality as viewed from major travel routes and developed recreation sites. Because regeneration treatments will not be visible from major travel routes or developed recreation sites in these management areas and will be visible from secondary forest roads only, standards and guidelines for scenery will be consistent with forest plan direction.

Developed Sites

No regeneration harvest units are expected to be visible from any developed recreation sites or major travel routes within the project area. Approximately 118 units are proposed for thinning treatments and four (330, 350, 890, and 860) are within foreground distance (300 feet -.5 mile) of Cougar Crossing Campground which is a key viewpoint. Because portions of unit 890 are within management area 11c which has a VQO of Scenic-Partial Retention Middleground and 11f which has a VQO of Retention foreground and can be seen from Forest Road 19 and Cougar Crossing Campground design features would ensure scenery is maintained consistent with forest plan standards and guidelines.

Unit 860 which has a VQO of Retention foreground is within foreground distance (300ft-.5mi) of Cougar Crossing Campground, however screening vegetation on the west side of the South Fork McKenzie River largely obscures views of the lower portions of this unit. The portion of the unit that is visible from the campground will be at the farther end of foreground distances (.25-.5miles). When viewed in context with the surrounding landscapes texture and landscape elements (previously thinned stands) the thinning treatment proposed for this unit will maintain a high degree of visual quality.

The remaining units analyzed for visibility from developed recreation areas fell into the farther end of middle-ground range (typically more than 2 miles). Field analysis revealed that in general views of these units are blocked by vegetation and topography. Portions of units 150 and 160 will be visible at middle-ground distance from Terwilliger Hot Springs parking lot. These units are in management area 11a which has a VQO of Scenic-Modification Middleground. This VQO allows for a moderately altered visual landscape as viewed from middleground distances that is compatible with natural surroundings.

Trails

Elk Creek Trail (#3510), Frissell Crossing Trail (#3320) and South Fork Trail (#3327) pass through or near proposed timber harvest treatments. These trails have class 3 designations and must meet Roaded Natural ROS opportunities at a minimum and a VQO of Partial Retention. The forest plan further specifies that for trails passing through management areas with a more restrictive ROS class the more restrictive standard shall apply. In this case the VQO for these trails is Partial Retention however the VQO of Retention (a more restrictive standard) applies where harvest treatments are proposed because the affected portions of these trails are in Management Area 5a which is the South Fork McKenzie River SIA (Special Interest Area). The VQO of Retention requires that the landscape character appears unaltered or intact and that travel corridors, including trails, retain a natural or near natural setting (Fig 3.12d).

Approximately 1.25 miles of the 91 miles of system trails in the project area or slightly less than 2% of total trail miles will be affected by proposed timber treatments (Figure 34). This includes approximately .5 miles of the Elk Creek Trail, .25 miles of the South Fork Trail and .5 miles of Frissell Crossing Trail. Prior to harvest treatments hikers may see tree marking associated with pre-sale preparation although these markings will be required to be placed on the side of trees facing away from trails. Hikers on trails that pass through harvest units will notice slash piles, stumps and skid trails during and in the short term after harvest treatments have concluded. As vegetative recovery takes place (3-6 years), and post treatment mitigation measures are implemented, evidence of harvest activity will become largely unnoticeable. In the short term a near natural setting will be retained and in the long term (6-10 years) the end result will be a natural setting with greater depth of views into the surrounding landscape due to decreased stand density, healthier and larger individual trees and less understory vegetation.

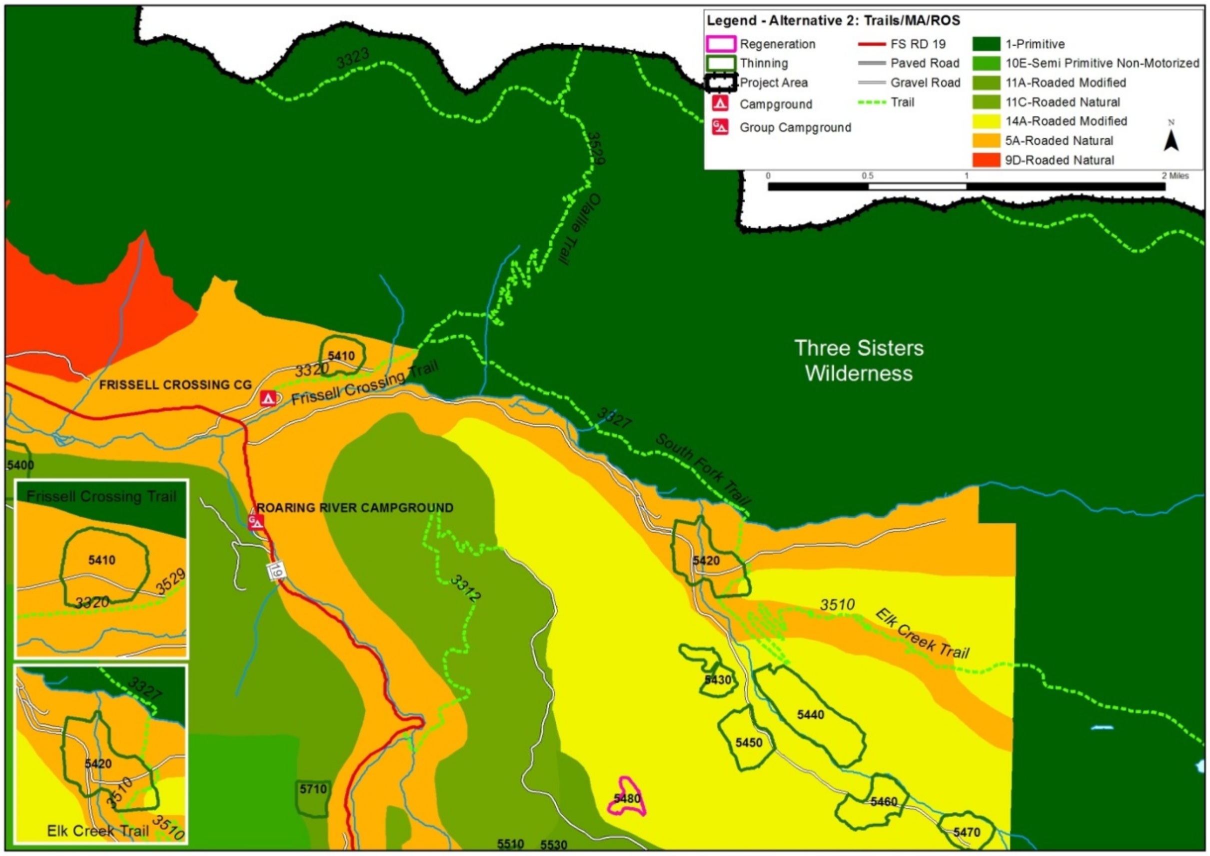


Figure 34. Trails Affected by Proposed Actions in the Green Mountain Project

Dispersed Sites

No significant effects to the 30 high use dispersed sites in the project area are expected as a result of timber treatments with Alternative 2 because timber harvest treatments are not proposed adjacent to any of these sites. Views into the surrounding landscape are constrained by nearby dense forest stands along the South Fork of the McKenzie River and views are additionally blocked by steep topography along the banks of the river. Some harvest units may be visible from the myriad of low use dispersed sites that can be found throughout the secondary road system however these sites are typically used by hunters primarily to access preferred hunting grounds and not for recreational activities where viewing scenery from dispersed sites is a primary activity.

Alternative 3

Alternative 3 would treat approximately 4,001 acres of stands ranging in age from 26-76 years old. No regeneration harvest would occur under this alternative so impacts to scenery would be largely the same as the proposed alternative because regeneration units would not be visible from key viewpoints in the proposed alternative. Views of harvest units from secondary forest roads that change from regeneration to thinning treatments would be less obvious to the casual forest visitor in Alternative 3 because there would be a less abrupt change in forest stand texture as viewed from secondary forest roads.

Alternative 2 and 3

Special Interest Areas

The Green Mountain project proposes to treat approximately 206 acres in the South Fork McKenzie SIA and approximately 59 acres in the Hidden Lake-Lulu Lake SIA in 39 units with thinning, gaps, and skips in Alternative 2 and 3. Design criteria to minimize impact on the SIAs are included for all of these units and for minimizing impacts of temporary road construction.

Proposed units would be in foreground view from Hidden Lake which has a natural appearing, almost primitive scenic condition. The close view and slope of the land formation at Hidden Lake would have the result that the two proposed units would tend to be central in the view. With design features, these units are expected to meet retention, as the planned thinning would be expected to make forest vegetation texture and pattern - seen close at hand here - more continuous and natural appearing. Temporary road construction and restoration would follow design criteria to meet retention, particularly important for the temporary road segment proposed above Hidden Lake.

Cumulative Effects

Alternative 2 and 3

Previous impacts that have modified the scenic landscape in the project area have been road construction, timber harvest activities and wildfires. There has been approximately 5,327 acres (11% of the project area) of timber harvest on federal lands within the project area, and 87% of treatments have been regeneration harvests. The earliest regeneration harvest occurred in the 1960's. Some of these stands have been thinned since the original harvest and some have not. There are two ongoing timber sale projects in the Green Mountain project area. The Forest Road 19 Salvage Project is currently underway in the project area and the Hartz Reoffer Project is planned for the near future. The Hartz reoffer project will not cumulatively add to scenery effects associated with the Green Mountain project. The Forest Road 19 Salvage Project is not expected to add long term cumulative impacts to scenery because tree removals will be widely dispersed along the road corridor and design features have been established to protect scenery.

Trail maintenance will continue to ensure they are open for public use. Recreation facility maintenance at developed recreation sites will also continue. Possible closures of some underutilized trails or trail segments may take place in the foreseeable future. Conversion of the former Homestead Campground into a fish release site and interpretive area took place in 2013 and additional work at this site will continue. No new developed recreation facilities are planned for the reasonably foreseeable future. Some overlap in time and space with the specific projects already underway and potential projects are recognized, however there are no significant additional cumulative effects anticipated for scenic resources as a result of implementation of the Green Mountain project.

3.11 Wilderness and Inventoried Roadless Areas (IRA)

3.11.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Wilderness and Inventoried Roadless Areas is the Green Mountain project area which is located in the following 6th field watersheds: South Fork McKenzie River/Cougar Reservoir, Rebel Creek, Augusta Creek, Roaring River and Elk Creek.

3.11.2 Affected Environment - Wilderness

A wilderness area is designated by congressional action under the Wilderness Act of 1964 and other wilderness acts. Wilderness is undeveloped Federal land retaining primeval character and influence without permanent improvements or human habitation (Willamette Forest Plan, page III-133). Wilderness recommendation and designation occurs at the forest planning level. The 283,630 acre Three Sisters Wilderness was established as part of the Wilderness Act of 1964.

44,909 acres of the Three Sisters Wilderness are within the Green Mountain project area. However, no treatments are proposed in the Three Sisters Wilderness. In general the portions of the Three Sisters Wilderness within the project area receives less use than those portions of the wilderness to the East which are accessed by the Pacific Crest National Recreation Trail and other popular system trails. Areas of higher use within the project area are French Pete Trail, Rebel Rock Trail and Crossing Way Trailhead. Numerous other smaller trailheads provide access to trails that connect to the more popular trails within the Three Sisters Wilderness trail system.

3.11.3 Environmental Consequences - Wilderness

Direct and Indirect Effects

Alternative 1

No treatments would occur with the implementation of Alternative 1 therefore no direct or indirect effects to the Three Sisters Wilderness would occur.

Alternative 2 and 3

No harvest or other connected actions would occur in the Three Sisters Wilderness. Units 5410 and 5420 are in in close proximity to the Wilderness and are adjacent to trails that access the Wilderness. Harvest activities and connected actions may require the need to temporarily close trails or reroute hikers to other trails that access the Wilderness area. Design features such as a requirement to orient leave tree and other boundary markers away from trails, remove boundary markers after harvest activity and mitigate slash piles within 150ft. of trails have been established to protect trails (see Chapter 2). A recreation specialist will be integrated into the design and layout phase to further mitigate potential impacts prior to project implementation and to make recommendations about ways to improve resource conditions where impacts have expanded at trailhead areas due to uncontrolled vehicle parking. These design features and recommended improvements to the trails that access wilderness will indirectly protect and benefit wilderness by protecting and enhancing the trail system and associated parking areas that allow access to the wilderness. To inform the public about potential disruptions to trail access into the Three Sisters Wilderness, information about project activities will be posted at developed recreation sites, trail heads and information stations along Forest Road19 and at the district office. The Willamette National Forest website will also be updated with this information.

Cumulative Effects

Alternative 1, 2 and 3

Effects to Wilderness from the Green Mountain project do no overlap in time or space with any past, present, or reasonably forseeable future actions (Appendix F); therefore no cumulative effects on Wilderness will occur.

3.11.4 Affected Environment – Inventoried Roadless Areas

Inventoried Roadless Areas (IRAs) were identified in the 2001 Roadless Area Conservation Rule in a set of inventoried roadless area maps (contained in Forest Service Roadless Area Conservation Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service), or any subsequent update or revision of those maps (36 CFR 294.11). These areas were set aside through administrative rulemaking and have provisions, within the context of multiple use management, for the protection of inventoried roadless areas. Most IRA boundaries are substantially identical to those identified as “Roadless Areas” referred to in the 1982 planning rule (36 CFR 219.17) and identified by the Forest Plan, FEIS, Appendix C; however some localized, minor differences in boundaries may exist.

Four IRAs are located in the Green Mountain project area: Chucksney Mountain (15,369 acres); French Pete A (1,668 acres); French Pete B (1,186) acres; and Roaring River (2,127 acres). These IRAs are illustrated in Figures 35 and 36.

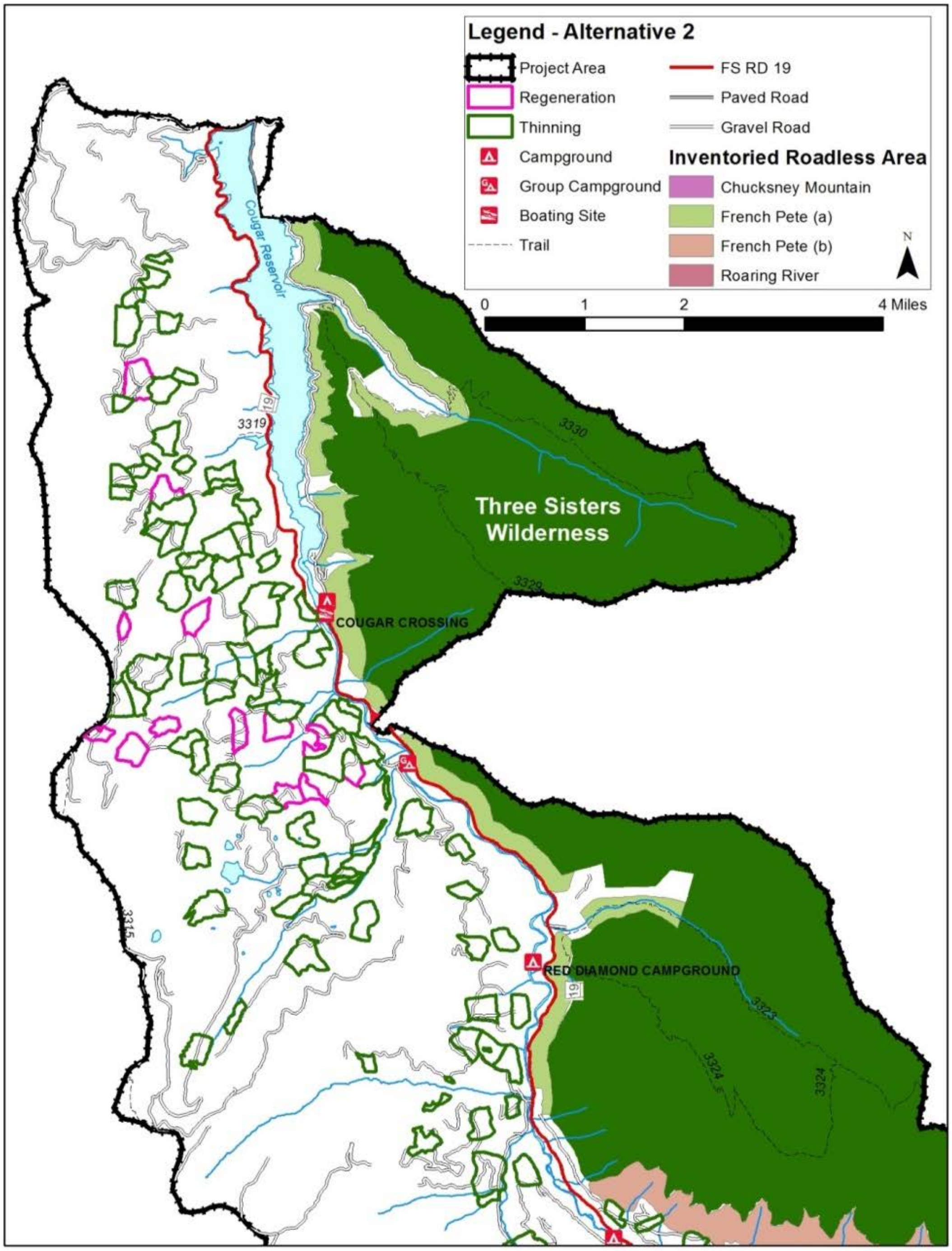


Figure 35. Inventoried Roadless Areas in the Green Mountain Project Area (North)

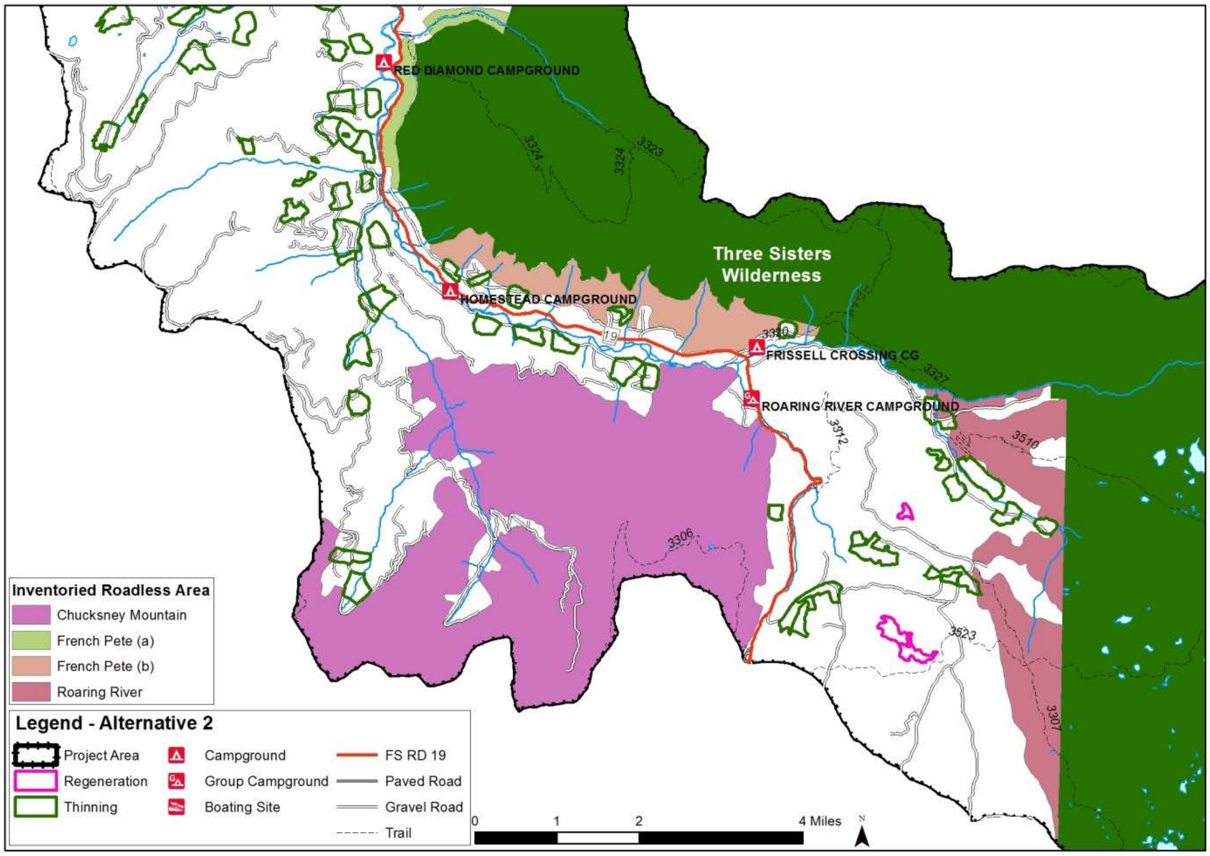


Figure 36. Inventoried Roadless Areas in the Green Mountain Project Area (South)

3.11.5 Environmental Consequences – Inventoried Roadless Areas

Direct and Indirect Effects

Alternative 1

No treatments would occur with the implementation of Alternative 1 therefore no direct or indirect effects to IRA's would occur.

Alternative 2 and 3 would have no effects on IRA's because no timber harvest or associated activities would occur within IRA's. 12 units in the Green Mountain project area are adjacent to an IRA (5120, 5130, 5140, 5320, 5370, 5380, 5400, 5410, 5420, 5440, 5470, and 5800). These units will have boundary markers established during implementation to ensure all project activities are restricted to areas outside the IRA boundaries.

Cumulative Effects

Alternative 1, 2 and 3

No effects to IRA's would occur with the Green Mountain project; therefore no cumulative effects on IRAs would occur.

3.12 Unroaded Areas

3.12.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to unroaded areas is the Green Mountain project area.

3.13.2 Affected Environment

Unroaded areas are isolated polygons of Forest Service land that have no roads and no evidence of past harvest activities. In the Green Mountain project area, approximately 19,220 acres have been identified as isolated polygons of unroaded areas that are at least one acre in size. Table 59 shows the number of polygons, size class, and the approximate acres of unroaded areas in the Green Mountain project area.

Table 59. Size Class and Acreage of Unroaded Areas in the Green Mountain Project Area

Number of Polygons	Size Class	Approximate Acres
171	1-99 acres	2,430
19	100-499 acres	4,037
3	500-999 acres	2,240
6	1000-4999 acres	10,513
0	5000+ acres	0
199	**Total**	**19,220**

These unroaded areas are not Wilderness, nor or they Inventoried Roadless Areas. There are no forest-wide or management area standards specific to unroaded areas in the Willamette Forest Plan or the Northwest Forest Plan. Unroaded areas are managed consistent with forest-wide standards and guidelines and by designated Forest Plan management area allocations.

3.12.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1

No treatments would implemented with selection of Alternative 1; therefore, no impacts to unroaded areas would occur.

Alternative 2 and 3

Alternative 2 and 3 propose some level of activity in unroaded areas, varying only by the number of polygons and acres treated. Timber harvest and associated activities in Alternative 2 would occur in 31 polygons on approximately 444 acres of unroaded areas. With implementation of Alternative 2, approximately 2.3 percent of the unroaded areas would be removed due to proposed harvest activities. Timber harvest and associated activities in Alternative 3 would occur in 13 polygons on approximately 75 acres of unroaded areas. With implementation of Alternative 3, approximately 0.39 percent of the unroaded areas would be removed due to proposed harvest activities. Table 60 and 61 show the polygons and acreage unroaded areas before and after implementation of Alternative 2 and 3.

Table 60. Unroaded Areas in Green Mountain Project Area with Implementation of Alternative 2

	Number of Polygons		Size Class	Approximate Acres	
	Before	**After**	**--**	**Before**	**After**
Alternative 2	171	175	1-99 acres	2,430	2,427
	19	20	100-499 acres	4,037	4,098
	3	3	500-999 acres	2,240	2,005
	6	6	1000-4999 acres	10,513	10,246
	0	0	5000+ acres	0	0
	199	**204**	**Total**	**19,220**	**18,776**

Table 61. Unroaded Areas in Green Mountain Project Area with Implementation of Alternative 3

	Number of Polygons		Size Class	Approximate Acres	
	Before	**After**	**--**	**Before**	**After**
Alternative 3	171	171	1-99 acres	2,430	2,456
	19	19	100-499 acres	4,037	4,024
	3	3	500-999 acres	2,240	2,240
	6	6	1000-4999 acres	10,513	10,425
	0	0	5000+ acres	0	0
	199	**199**	**Total**	**19,220**	**19,145**

Effects to the physical and biological resources in the Green Mountain project area, including those in units proposed in unroaded areas, are disclosed in the applicable resource sections of the DEIS and are not reiterated here. Environmental effects to resources in unroaded areas due to the implementation of proposed project activities would be consistent with applicable laws, regulations, and Forest Plan management area standards and guidelines.

Cumulative Effects

Alternative 1, 2 and 3

The effects to unroaded areas from the Green Mountain project do not overlap in time and space with effects from any past, present, or reasonably foreseeable future actions (see Appendix F); therefore no cumulative effects to unroaded areas would occur.

3.13 Wild and Scenic Study River

3.13.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to the South Fork McKenzie River Wild and Scenic Study River (WSSR) is that portion of the river within the Green Mountain project area.

3.13.2 Affected Environment

The South Fork McKenzie Wild and Scenic Study River is located on the McKenzie River Ranger District of the Willamette National Forest in Lane County, Oregon. The river roughly parallels Forest Road 19 which is part of the West Cascades National Scenic Byway for much of its course. The rivers origins are in the Three Sisters Wilderness and it flows in a roughly North-westerly direction terminating at its confluence with the main stem of the McKenzie River at approximately mile post 43 of the McKenzie Highway (Highway 126).

In the Oregon Omnibus River Act of 1988, the South Fork McKenzie River was designated as a Wild and Scenic Study River to determine its eligibility for Wild and Scenic River designation. The study was initiated in 1989, and the South Fork was determined eligible, with plans to complete the study at revision of the Willamette National Forest Land and Resource Management Plan. The 1990 Willamette Land and Resource Management Plan did not recommend designation as a Recreational River under the Wild and Scenic Rivers Act; however, the river remained a Wild and Scenic Study River. An eligibility determination was completed in 1992 and four outstandingly remarkable values (ORV's) were found to meet the criteria for eligibility. These ORV's are Scenery, Recreation, Fish and Prehistoric. Management actions within the South Fork McKenzie Wild and Scenic Study River may not diminish any of the outstandingly remarkable values for which the river was found eligible. The Wild and Scenic River System classifies designated rivers into three classifications; Wild, Scenic and Recreational.

(1) Wild river areas – Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

(2) Scenic river areas – Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

(3) Recreational river areas – Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

The South Fork McKenzie Wild and Scenic Study River corridor encompasses approximately 8,224 acres and is divided into three segments. Segment two and three are classified as Recreation while segment one is classified as Wild. Segment 1 flows 5.2 miles from the headwaters of Beaver Marsh to the Three Sisters Wilderness Boundary. It is classified as Wild because it lies within the Three Sisters Wilderness, is only accessible by trail at its headwaters, is unpolluted, un-impounded and its shoreline is wholly undeveloped. Segment 2 flows 16 miles from the Wilderness boundary to Cougar Reservoir and lies within the South Fork Special Interest Area (SIA). It is classified as Recreational because it is paralleled by the Aufderheide National Scenic Byway and crossed by several bridges and several developed campgrounds and numerous dispersed recreation campsites are located near the rivers banks. Segment 3 flows 4.5 miles from below Cougar Dam to the rivers confluence with the McKenzie River. Its classification is Recreational because it is paralleled by the Aufderheide National Scenic Byway and Delta Campground and numerous dispersed campsites, access road spurs and trails are located within the river corridor.

Evidence of timber harvest is predominant throughout this segment. Cougar Reservoir is not part of the South Fork McKenzie River Wild and Scenic Study River.

Outstandingly Remarkable Values (ORV's)

The Omnibus Oregon Wild and Scenic Rivers Act of 1988 added segments of 40 rivers to the national Wild and Scenic River system. It also called for the study of seven Oregon rivers to determine whether they are eligible and/or suitable for inclusion into the national system. A 25.7 mile stretch of the South Fork McKenzie River is one of the study rivers. In 1992, an eligibility study was conducted for the South Fork McKenzie River and it determined that the river was eligible for inclusion into the national system. In order for the river to be included, a Legislative Environmental Impact Statement (LEIS) would need to be completed to determine where the South Fork McKenzie River is "suitable" for designation as a Wild and Scenic River. Congress will ultimately decide if the river is designated. To qualify as an Outstandingly Remarkable Value (ORV) a river related value must be a unique, rare, or exemplary feature significant at a regional or national level. The Forest Service Land and Resource Management Planning Handbook, Chapter 8.21c states that "…such a value would be one that is a conspicuous example of a value from among a number of similar values that are themselves common or extraordinary".

Scenery

Scenery was determined to meet the criteria as an ORV because the corridors mature and old growth vegetation, combined with the beauty of the river offer outstanding scenery to local visitors and many from outside the region. The area's vegetative diversity (e.g. color, size and texture) creates a highly visual backdrop. The Aufderheide Drive National Scenic Byway, designated in 1988, is recognized outside the region for its scenery and the river and its corridor are its predominant features.

Recreation

Recreation was determined to meet the criteria as an ORV because the river and its corridor are regionally known for its diverse recreation opportunities and facilities. The river is especially known for its many undeveloped campsites in segment 2 and 3. Within a short distance of the river in segment 2, hikers can make day or overnight visits to the Three Sisters Wilderness. Below Cougar Dam in segment 3, spring chinook and steelhead runs exist, offering angling opportunities similar to the McKenzie River. Recreation as an ORV meets the criteria values for segments 2 and 3 due to the variety of recreational opportunities that exist. Segment 1, inside the Three Sisters Wilderness, does not meet the criteria for an ORV because the variety of recreational opportunities is limited. Anglers do fish segment 2 of the river primarily bank fishing or wading from access areas such as dispersed campsites or small roadside pull outs with associated undeveloped, user created trails to the river. Boating use is generally low in segment 2 (Cougar Reservoir to the Wilderness Boundary) of the river, however it is moderate in the section between French Pete Campground and Cougar Reservoir. This section of the river requires moderate river running skills and has been highlighted in the book Soggy Sneakers Guide to Rivers which identifies the river as "…one of the most interesting rivers of the upper Willamette River system". It further states that that river "offers a superb experts only run at flows above 2,000 cubic feet per second". Boat based fishing is not a common occurrence above the reservoir due to the narrow, swift and technical character of the river and suitability for only small craft and because there are no developed boat launches. Segment 3 (below Cougar Dam) is floated by rafts and drift boats typically in support of fishing but it is also run by kayakers. This section is frequently used by outfitters and guides and is also popular for bank fishing and wading anglers.

Fish

Fish was determined to meet the criteria as an ORV because the river's overall diversity of fish, anadromous and bull trout populations, and existing and potential habitat, are exemplary compared to similar rivers within the SCORP region 8. Segment 3 contains anadromous runs of spring Chinook and summer steelhead. Resident fish in section 3 is nearly equal to that of the McKenzie River which is noted for its outstandingly remarkable fish populations. Populations within the South Fork McKenzie River include coastal cutthroat trout, hatchery and native rainbow trout, bull trout, mountain whitefish, and non-game species (e.g., sculpin, dace, and suckers). Segment 1 and segment 2 support populations of all the species above. All species are naturally reproducing with the exception of hatchery rainbow trout. Summer steelhead, first introduced in 1968, are either hatchery strays or are naturally reproducing. In 1993, the Oregon Department of Fish and Wildlife (ODFW) began releasing hatchery Chinook salmon above Cougar Reservoir to provide marine derived nutrients to the system and to provide bull trout with a more robust prey base.

Cultural (Pre-historic)

Knowledge of prehistoric use of the river drainage is incomplete. Three sites have been found to be eligible for inclusion in the National Register of Historic Places (NRHP) and numerous other sites not eligible for inclusion to the NRHP have been recorded. Two undisturbed rock shelters have been found and are excellent examples of long-term, multi-occupancy dwellings. One structure represents the only tested and dated rock shelter within the McKenzie Basin. The South Fork McKenzie River is known to have been extensively used and occupied by aboriginal tribes. For these reasons prehistoric was found to meet the criteria as an ORV.

3.13.3 Environmental Consequences

Direct and Indirect Effects - Scenery

Alternative 1- No Action

Alternative 1 would have no direct, indirect or cumulative effects because it would not implement any timber harvest treatments in the South Fork McKenzie River Wild and Scenic River Study Corridor.

Alternatives 2 and 3

The preferred alternative proposes to implement a total of 553 acres of timber harvest treatments within the Wild and Scenic Study River corridor. Treatments proposed include thinning, gaps and skips and would be exclusively within segment 2 (Recreational) and no treatments are proposed in segment 1 (Wild) or segment 3 (Recreational).

To evaluate potential effects to scenery along the South Fork McKenzie Wild and Scenic Study River viewsheds were identified and analyzed against the projects proposed actions and action alternatives. Viewsheds are characterized as those visible areas near important travel corridors where viewing scenery is an important component of the visitor experience. For the purposes of this analysis the viewsheds identified were the surface waters (area within the ordinary high water mark) of the South Fork McKenzie River and its banks. An emphasis was placed on areas where shoreline and wading for fishing are accessible by road or trail. Also analyzed is the portion of the West Cascades National Scenic Byway (Forest Road 19) within the Wild and Scenic Study River corridor. Within these viewsheds, specific viewpoints that provide longer duration views of the landscape were analyzed in more detail. Viewpoints were identified as areas such as bridges that cross the river and developed recreation sites that provide views into the river corridor. Viewing scenery from the surface waters and banks of the South Fork

McKenzie River is largely constrained by thick forest and riparian vegetation and is further reduced by steep banks and topography.

Views of the river and river corridor that can be of longer duration are particularly important for scenery and numerous points on Forest Road 19 provide these opportunities. These locations were identified as bridges, campgrounds, pullouts and dispersed recreation areas. Although the project area surrounds these locations the specific units proposed for treatments within the Wild and Scenic Study River corridor will generally not be visible from them. Treatments in these few visible units will reduce stand densities which will increase growth and vigor of larger trees and enhance vegetation diversity by increasing the productivity of hardwoods and shrubs. This will add complexity to the range and variety of color, form and texture of the forest and highlight the brilliant contrast in color between hardwoods and shrubs during the fall against the backdrop of evergreen forest. Thinning of overstocked stands will improve depth of view into the surrounding forested landscape which will serve to highlight mature, old growth trees. The characteristics of the river itself that are key elements for meeting the scenery criteria such as clear, swift flowing water with an interesting mix of pools, riffles and meandering channels as well as cascading falls and whitewater rapids will not be altered in any way as a result of project activities. For these reasons the action alternatives associated with the Green Mountain project will not diminish the scenery ORV.

Direct and Indirect Effects - Recreation

Alternative 1- No Action

Alternative 1 would have no direct, indirect or cumulative effects because it would not implement any timber harvest treatments in the South Fork McKenzie River Wild and Scenic River Study Corridor.

Alternatives 2 and 3

The South Fork McKenzie River Wild and Scenic Study River eligibility determination found that recreation met the criteria as an ORV. The specific elements of this ORV are tied to recreational uses such as fishing, boating, hiking, camping and recreational driving. Actions proposed by the Green Mountain project must not diminish the components that comprise this ORV. Anglers will retain full historical access to spur roads, dispersed sites, roadside parking areas and trails that access the river. In some cases access to the river will be increased due to the opening of forest roads that were previously closed. The rivers structure and character will not change and fish populations will not be negatively impacted so there will be no negative effect to the availability of fish for recreational fishing. Boating will not be impeded in any way as a result of actions proposed by the project. Opportunities to access dispersed campsites and developed campgrounds will not be reduced and the landscape character as viewed from these locations will be maintained, and in some cases enhanced, due to vegetation treatments that will increase vegetation complexity and diversity in the nearby forest. Access to hiking trails will not be affected and the characteristics of the trails that make them attractive to visitors will not be altered. Recreational driving along the Aufderheide Drive National Scenic Byway will continue to offer “one of the best opportunities in the nation to view a variety of forest management activities” (National Forest Scenic Byways Guide, USDA Forest Service, 1989). Sightseers will continue to be able to view an array of colors, particularly during the fall season, where shrubs and hardwoods display a brilliant contrast to the dominant evergreen vegetation. In some cases scenic character will be enhanced due to treatments that will increase the presence of shrubs and hardwoods further highlighting this contrast. Views of the river will remain unchanged from points along Forest Road 19 and the river will retain its visually interesting mix of rapids, pools and clear water. For these reasons the action alternatives associated with the Green Mountain project will not diminish the recreation ORV.

Direct and Indirect Effects - Fish

Alternative 1 – No Action

Alternative 1 would have no direct, indirect or cumulative effects because it would not implement any timber harvest treatments in the South Fork McKenzie River Wild and Scenic River Study Corridor.

Alternatives 2 and 3

The direct and indirect effects to Alternatives 2 and 3 are the same. There is the potential for fish to be affected directly during bridge work over Hardy Creek. The bridge over Hardy Creek is approximately 300 feet away from the South Fork McKenzie so it is within the WSSR corridor. In Hardy Creek, a piece of equipment (i.e. an excavator) would be required to cross the creek at least once in order to replace an existing bridge that is in disrepair. When the equipment crosses Hardy Creek there is the potential to harass, harm, or cause mortality to individual fish. The most likely fish to be found in lower Hardy Creek, based on Forest Service stream surveys, is the coastal cutthroat trout. The coastal cutthroat trout is ubiquitous in the WSSR corridor and the tributary streams entering the South Fork McKenzie.

Fish could be directly affected by the “fall and leave” treatments in Elk Creek associated with unit 5420. It is proposed to fall trees into Elk Creek in order to enhance fish habitat conditions. Stream surveys indicated that woody material was lacking as a habitat feature in Elk Creek and this has adversely affected habitat conditions. When a tree is felled into the creek, there is the potential to harass, harm, or cause mortality to individual fish. Elk Creek could have spring Chinook salmon, bull trout, rainbow trout, and coastal cutthroat trout in the system during project implementation.

The projects in Elk Creek and Hardy Creek have the potential to adversely affect individual fish during implementation. However, the impacts to individual fish would not be substantial enough to cause a degradation in the overall fish populations in the WSSR. Felling trees into Elk Creek would have the potential to adversely affect individual fish in the short-term (i.e. immediately when the tree hits the stream channel) but would enhance fish habitat in the WSSR in the long-term (i.e. decades).

It is proposed to thin 553 acres of previously harvested stands in the WSSR corridor. None of these units are directly adjacent to the South Fork McKenzie. That is, there is typically a vegetated buffer of mature to old growth trees between the units and the river. These younger stands are densely stocked so thinning would enhance conditions within the WSSR corridor. However, these units are greater than one site-potential tree height distant from the South Fork McKenzie so there would be no indirect effects to the fish ORV.

Direct and Indirect Effects – Cultural

Alternative 1 – No Action

Alternative 1 would have no direct, indirect or cumulative effects because it would not implement any timber harvest treatments in the South Fork McKenzie River Wild and Scenic River Study Corridor.

Alternatives 2 and 3

Timber harvest, new and temporary road construction, ground base and skyline yarding and post-harvest fuel treatment would be greater under this alternative producing an increased amount of ground disturbance. Ground disturbance can affect the surface and subsurface integrity of an archaeological site and thus its significance to the National Register of Historic Places.

Since appropriate and approved surveys and cultural site protection measures are already in place (see Design Measures Chapter 2), the potential direct effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract clause BT6.24 must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during timber sale operations

Cumulative Effects

The Cascade Thin project was completed in 2015 and thinned approximately 7.6 acres within the South Fork McKenzie River Wild and Scenic Study River corridor. The treatment acreages were on the northern edge of the WSSR corridor, north of the river and Forest Road 19. Because thinning treatments are consistent with the ORV's of scenery and recreation and because these treatments are not visible from the river, Forest Road 19, system trails or any developed recreation sites the ORV's of recreation and scenery would not be cumulatively affected. The treatments did not affect fish populations, water quality or archeological sites so the Cascade Thin project will not add cumulatively to the ORV's of fish or pre-historic.

The Forest Road 19 Hazard Tree Removal Salvage Project selectively removed approximately 120 trees adjacent to Forest Road 19. Because of this projects small scale it will not impact any of the four the ORV's applicable to the Wild and Scenic Study River. The 410 Fuels reduction project has thinned and will continue to thin forest stands along the lower reaches of the Wild and Scenic Study River in segment 3 which is categorized as Recreational. No treatments are proposed in segment 3 by the Green Mountain project and fuels thinning treatments are consistent with the recreational designation of that segment which recognizes that evidence of timber harvest is a predominant feature of the surrounding landscape.

The recently proposed Roadside Hazardous Fuels Reduction Project would reduce the abundance of ladder fuels within road corridors and adjacent to the Three Sisters Wilderness with the goal of creating a firebreak to prevent catastrophic wildfire. This project proposes to cut all vegetation under 10" in diameter within a road prism of 100 feet on both sides of the road. Any areas that would have the potential to diminish the recreation, scenery, fish or Prehistoric ORV's would either be dropped or modified during the project planning process to ensure consistency with Wild and Scenic Study River management.

The proposed fall and leave treatments in Elk Creek overlap in time and space with the Upper South Fork McKenzie River Enhancement Project (2008). The cumulative effect of the project in Elk Creek would be to further enhance habitat conditions for the fish ORV within the WSSR.

Section 10 Determination – Finding

Based on the analysis detailed in this resource assessment it is determined that the proposed Green Mountain Project is consistent with Section 10 of the Wild and Scenic Rivers Act. The action alternatives will not diminish or degrade any of the characteristics which are central to the outstandingly remarkable values (ORV's) that apply to the South Fork McKenzie River Wild and Scenic Study River. The fish ORV will be enhanced by felling trees into Elk Creek and the free flowing condition and water quality of the South Fork McKenzie River will be maintained.

3.14 Special Interest Areas

3.14.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects is the units in the South Fork McKenzie River Special Interest Area (SIA) and the Hidden Lake-Lulu Lake SIA in the Green Mountain project area.

3.14.2 Affected Environment

Special Interest Areas (SIAs) are land allocations designated in the 1990 Willamette National Forest Land and Resource Management Plan due to their special qualities, such as cultural, historic, geologic, botanical or scenic values. SIAs are identified as Management Area 5a in the Forest Plan.

The 1990 Willamette National Forest Land and Resource Management Plan requires preparation of an Implementation Guide to define management objectives for each SIA. Standard and Guideline MA-5a-01 states that "(A)n Implementation Guide shall be prepared for each SIA describing the site specific management objectives, enhancement programs, and other acceptable uses and activities. The extent of development within any area will be based on an analysis of the resource conditions and protection needs of the site. Site development plans will be prepared as part of the Implementation Guide, showing the design and location of proposed facilities".

Two SIAs are located in the Green Mountain project area: South Fork McKenzie SIA and Hidden Lake-Lulu Lake SIA (Figure 37).

South Fork McKenzie River Special Interest Area

The 5,114 acre South Fork McKenzie River SIA is recognized for its exceptional scenic, recreational, hydrological and biological characteristics. The SIA lies in a broad, glaciated valley bottom and is characterized by stands of mature and old-growth Douglas-fir and river-oriented developed and dispersed recreation opportunities like driving for pleasure, camping, hiking, recreational boating, fishing, and wildlife viewing. The South Fork McKenzie SIA is located approximately 1/4 mile on either side of Rd. 19 (West Cascades National Scenic Byway) beginning at the southern tip of Cougar Reservoir and continues south and east to Frissell Crossing where it divides into two forks. One fork continues east bordering the South Fork channel until it ends at the Three Sisters Wilderness boundary; while the second fork follows a south/southeasterly course to include perennial portions of the Roaring River channel, as well as McBee Creek, which flows to Box Canyon.

Management actions within the South Fork McKenzie SIA are designed to focus on protection of the area's resources while fostering public use and enjoyment. Current resource conditions, desired future conditions, management objectives, and enhancement programs for the South Fork McKenzie SIA are described in detail in the *South Fork McKenzie Watershed Analysis* and the *South Fork McKenzie Special Interest Area Implementation Guide* which are available in the Green Mountain project record.

Hidden Lake - Lulu Lake Special Interest Area

The Hidden Lake-Lulu Lake SIA is approximately 597 acres in size. The variety of elevation, slopes, and soil types provides for a variety of habitats such as: lakes, wetlands, steep forested slopes, cliffs, and open talus slopes. Old-growth forest stands within the SIA consist of Douglas-fir, Pacific Silver Fir, and pockets of Alaska yellow cedar. These areas are distinguished not only by tree size, but by vegetative diversity and structural complexity (canopy gaps, saplings, snags, down wood, etc.). A few of the more distinct habitats are large areas of dry talus slopes covered by mosses and lichens and talus slopes dominated by vine maple and Sitka alder. Large dry cliffs are scattered throughout the western half, particularly north and west of Hidden and Lulu Lakes. Overall, the Hidden Lake-Lulu Lake SIA supports a broad spectrum of vegetation, wildlife, and amphibian life; in addition to attracting many forest users.

Management actions within the Hidden Lake-Lulu Lake SIA focus on the protection of the area's natural resources while fostering public use and enjoyment. Management will focus on the recreational aspect and botanical quality of the area. Current resource conditions, desired future conditions, management objectives, and enhancement programs for the Hidden Lake-Lulu Lake SIA are described in detail in the *Hidden Lake-Lulu Lake Implementation Guide* which is available in the Green Mountain project record.

Units Proposed for Harvest within the SIA

Approximately 265 acres of previously managed stands are proposed for harvest in SIAs under Alternative 2 and 3. 206 acres are proposed for harvest in the South Fork McKenzie River SIA and 59 in the Hidden Lake-Lulu Lake SIA. These stands are previously managed stands that have been harvested as recently as 1985. Little understory development and species diversity appears to be in the stands and they are characterized as dense, close-canopied, even-aged stands. These stands are in the stem exclusion stage (see Section 3.1.2 for additional information). The stem exclusion stage occurs after canopy closure, as the stand begins to differentiate into size classes and shading and competition for nutrients and water by larger trees leads to death of smaller trees and much or all of the understory vegetation. These previously managed stands have a Stand Density Index (SDI) averaging 347, over 58 percent of SDImax a metric indicating that these stands are competing with each other and point of competition induced mortality (for a further discussion of SDI, please refer to Section 3.1.2).

Table 62 displays the average stand characteristics for stands considered for harvest in the SIAs. Figure 38 illustrates the current condition of the previously managed stands in the SIA proposed for harvest with the Green Mountain project.

Table 62. Average Stand Characteristics of Managed Stands Considered for Harvest in the SIAs

Stand Type	Total Trees Per Acre	Trees per acres available for harvest[1]	Quadratic Mean Diameter[1]	Average Stand Height[1]	Canopy Cover Percent[1]	Average Age[1]	Basel Area[1]	Stand Density Index[1]
Managed	749	193	13	86	67	38	191	347

[1]: Based on trees seven inches and greater DBH, because seven inches is the minimum DBH of a tree considered for harvest in the Green Mountain project.

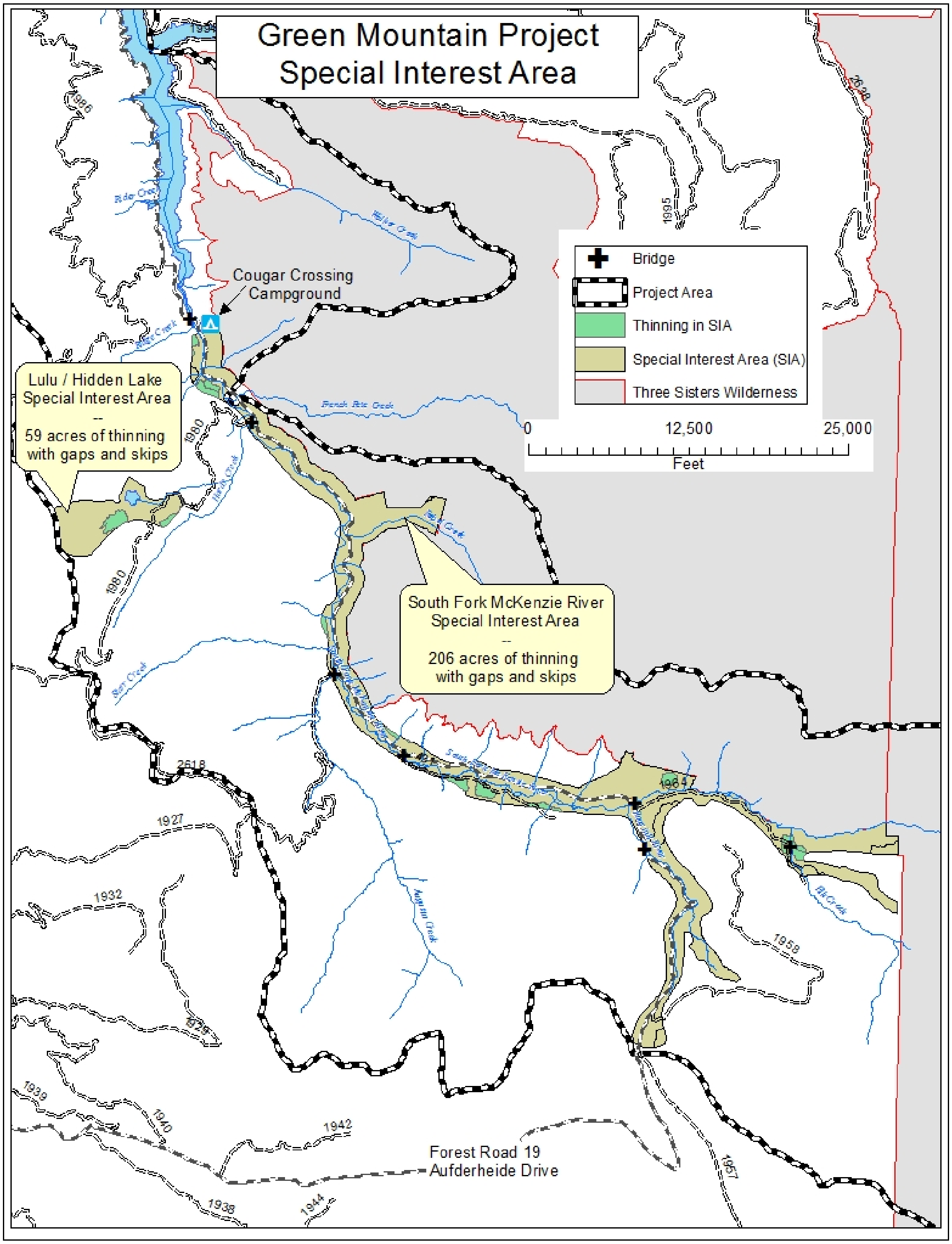


Figure 37. Special Interest Areas in the Green Mountain Project Area

Figure 38. Previously Managed Stand in SIA in Green Mountain Project Area

3.14.3 Proposed Forest Plan Amendment

Forest Plan Background

The Willamette National Forest Plan was authorized on July 31, 1990. The Willamette National Forest Plan provides a long-range strategy for managing the Willamette National Forest. The Forest Plan "guides all natural resource management activities and establishes management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resources management" (Forest Plan, I-1). The Forest Plan provides management direction through the designation of specific management areas and standards and guidelines specific to these designations.

The Forest Plan was amended by the Northwest Forest Plan (1994), which established additional management areas, standards, and guidelines associated with Matrix, Riparian Reserves, Adaptive Management Areas, and Late-Successional Reserves. When there is overlap of management areas, the more restrictive standards and guidelines apply (Northwest Forest Plan 1994a p. A-6).

Forest Plan Amendments

Plan amendments are intended to be an adaptive management tool to keep plans current, effective, and relevant between required plan revisions (every 15 years). Amendments help Responsible Officials adapt an existing plan to new information and changed conditions. Amendments may be broad or narrow in scope, depending on the need to change the plan. Amendments may be project-specific. If a proposed project is not consistent with the plan, the Responsible Official has the option to start a plan amendment that, if approved, would accommodate the project.

Under the 2012 Planning Rule (Title 36, CFR, Part 219–Planning) it states:

> 36 CFR 219.13(a) *Plan amendment.* A plan may be amended at any time. Plan amendments may be broad or narrow, depending on the need for change, and should be used to keep plans current and help units adapt to new information or changing conditions. The responsible official has the discretion to determine whether and how to amend the plan. Except as provided by paragraph (c) of this section, a plan amendment is required to add, modify, or remove one or more plan components, or to change how or where one or more plan components apply to all or part of the plan area (including management areas or geographic areas).

The amendment process as described at 36 CFR 219.13(b) is:

> (1) Base an amendment on a preliminary identification of the need to change the plan. The preliminary identification of the need to change the plan may be based on a new assessment; a monitoring report; or other documentation of new information, changed conditions, or changed circumstances. When a plan amendment is made together with, and only applies to, a project or activity decision, the analysis prepared for the project or activity may serve as the documentation for the preliminary identification of the need to change the plan;
>
> (2) Provide opportunities for public participation as required in §219.4 and public notification as required in §219.16. The responsible official may combine processes and associated public notifications where appropriate, considering the scope and scale of the need to change the plan; and
>
> (3) Amend the plan consistent with Forest Service NEPA procedures. The appropriate NEPA documentation for an amendment may be an EIS, EA, or CE, depending upon the scope and scale of the amendment and its likely effects. A proposed amendment that may create a significant environmental effect and thus require preparation of an EIS is considered a significant change in the plan for the purposes of NFMA

Proposed Forest Plan Amendment

The Green Mountain project proposes to treat approximately 206 acres in the South Fork McKenzie SIA and approximately 59 acres in the Hidden Lake-Lulu Lake SIA with thinning, gaps, and skips in Alternative 2 and 3. No programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline MA-5a-05: "*No programmed harvest shall be scheduled.*"

Because no programmed timber harvest is currently allowed in SIAs per Management Area Standard and Guideline 5a-05, a *one-time* exception approved with a Forest Plan Amendment (#58) would be required. This one-time Forest Plan Amendment would allow the stands in the SIAs to be treated.

Need and Rationale for Amendment

As stated above in Section 3.14.2, stands proposed for harvest in the SIA are previously managed stands that have been harvested as recently as 1985. Little understory development and species diversity appears to be in the stands and they are characterized as dense, close-canopied, even-aged stands. These stands are in the stem exclusion stage. The stem exclusion stage occurs after canopy closure, as the stand begins to differentiate into size classes and shading and competition for nutrients and water by larger trees leads to death of smaller trees and much or all of the understory vegetation. These previously managed stands have a Stand Density Index (SDI) averaging 347, over 58 percent of SDImax a metric indicating that these stands are competing with each other and point of competition induced mortality (for a further discussion of SDI, please refer to Section 3.1.2).

If the stands in the SIAs are left untreated, these overstocked stands may have decreased tree growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. Diameter growth would be low or would decline, and live crown ratios would get smaller. Trees within these stands would become less vigorous and more susceptible to insects and diseases. Competition-induced mortality would increase, thus increasing small diameter <15” snags and down wood. The down material would increase fuel loadings, fire risk and vulnerability of the stands to insect infestations. Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation.

Implementation Guides for both SIAs include objectives and enhancement recommendations for managing second growth plantations to accelerate growth and more quickly attain attributes of older stands; implementing silvicultural treatments in stands where densities are high or showing a reduction of growth to improve tree and stand vigor; maintaining health and aesthetics while maintaining decadence of the forest through harvest of even-aged, previously managed stands; and accelerating late successional characteristics in young stands to enhance connectivity corridor between Late Successional Reserves. Treatments proposed in the SIAs would move stands towards achieving the objectives and enhancement recommendations listed above and described in further detail in the Implementation Guides.

3.14.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no direct, indirect or cumulative effects on the designated SIAs because it would not implement any timber harvest treatments in SIA. However, effects would occur to the stands in the SIAs proposed for treatment. If the stands in the SIAs are left untreated, these overstocked stands may have decreased tree growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. Diameter growth would be low or would decline, and live crown ratios would get smaller. Trees within these stands would become less vigorous and more susceptible to insects and diseases. Competition-induced mortality would increase, thus increasing small diameter <15” snags and down wood. The down material would increase fuel loadings, fire risk and vulnerability of the stands to insect infestations. Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation.

Alternative 2 and 3

The treatments proposed by the Green Mountain project would be consistent with applicable forest plan standards and guidelines, as amended by this project, and will serve to meet enhancement program objectives as described in the South Fork McKenzie and Hidden Lake-Lulu Lake Implementation Guides. Below is a description of how treatments proposed by the Green Mountain project would serve to meet objectives and enhancement program objectives while protecting other important resources in the SIAs.

Vegetation

Activities such as harvest to encourage diameter and height growth, and snag and down wood enhancement, are desirable to accelerate the remaining trees “blending in” with the surrounding stands.

Active management to help development of characteristics similar to the unmanaged stands can be accelerated (Bauhus et al. 2008). As noted in Section 3.1 thinning in young uniform stands can improve horizontal and vertical stand diversity. Early commercial thinning has been shown to be beneficial to the future development of understories, the promotion of natural regeneration, and in enhancing biodiversity (Muir et al 2002). With early thinning, overstory trees can develop deep canopies and large-diameter branches in open stands (McGuire et al 1991). Low overstory density facilitates the establishment of understory trees (McGuire et al 1991, Bailey and Tappeiner 1998, Miller and Emmingham 2001).

The Green Mountain Project would remove conifer trees through commercial thinning across all size classes, but would primarily consist of smaller diameter trees with an emphasis on retention of sugar pine and white pine. These species may however be cut for operational purposes. This prescription would also maintain or increase vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Heavier thinning would likely promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. Many old trees grow rapidly when they are young (30-100 years), producing large stems and crowns. Evidence suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition (Franklin et al 1981, Tappeiner et al. 1997). Old-growth stands typically have multiple canopy layers, and thinning promotes a second cohort by allowing for natural regeneration to occur (Tappeiner et al. 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established tolerant conifers (Winter et al 2002a 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

Untreated skips would be left. Untreated areas within treated stands would provide diversity within a larger stand. These areas would be allowed to have natural processes take place such as inter-tree competition, which would create snags and down woody material. However, there would be an edge effect that could take place along the edge of the skip. Skips would be dispersed between riparian and non-riparian areas. Depending on the location and positioning of the skip, the edge effect could allow for more light to reach the trees along the edge and forest floor. This extra light could lead to greater growth of some of the individual trees, forbs, and shrubs along the edge.

Implementation of skips would be with hard boundaries flagged on the ground along unit boundaries and within units. Additionally, internal skips may include identifying a tree and not including for harvest any other tree within a specified distance of that identified tree.

Scenery and Recreation

Management Area 5a (Special Interest Areas) have an ROS (Recreation Opportunity Spectrum) allocation class of Roaded Natural and an associated Visual Quality Objective (VQO) of Retention. An ROS class of Roaded Natural provides for a social setting where there is an opportunity to affiliate with others but with some chance for privacy in a mostly natural environment. Physical controls may be in place such as campgrounds, day use areas, trails and vehicle barriers to protect resources but must blend with the natural surroundings. A VQO of Retention requires a mostly naturally appearing setting with vegetation modification done to maintain desired visual characteristics. Travel corridors must retain a natural or near natural setting and activities must be conducted so that they are completely subordinate to the character of the landscape and are not evident to the casual forest visitor. Further, any management activities should repeat form, line, color and texture of elements found in the natural landscape.

The South Fork McKenzie SIA Implementation Guide identifies desired conditions for recreation and scenery in the following ways: maintain the integrity of viewshed, avoid degradation of scenery; manage for old growth "cathedral" character (large diameter older growth forest with minimal understory), maintain recreational driving, free flowing traffic, and public safety (e.g. restrictions on industrial traffic on weekends); avoid loss of dispersed recreation opportunities; provide opportunities for dispersed recreation; maintain dispersed recreation experiences by rehabilitating, reconstructing, or relocating sites; avoid road proliferation and off-road vehicle use; and enhance opportunities for stream-related recreation.

In addition, the Implementation Guide has identified management objectives to meet desired future conditions. These objectives are to be met through maintenance, restoration, monitoring and evaluation and consist of the following:

- The SIA will provide safe, quality dispersed and developed recreation opportunities for use and enjoyment of forest visitors
- The SIA will provide a range of recreation opportunities
- As you travel through the SIA, you will feel as though you are traveling through a natural area. The South Fork corridor will move from a moderately to slightly altered visual condition, with management activities less apparent to the casual visitor.
- The SIA will provide opportunity for interpretive experiences and will be compatible with the West Cascades National Scenic Byway Plan, and the South Fork McKenzie Wild and Scenic Study River.
- The SIA environment will appear minimally affected by management activities

Scenery

Viewsheds were identified and analyzed to determine effects to scenery in the South Fork McKenzie and Hidden Lake-Lulu Lake SIA's. Viewsheds are characterized as those visible areas near important travel corridors where viewing scenery is an important component of the visitor experience. For the purposes of this analysis, the viewsheds identified for the South Fork McKenzie River SIA are the surface waters (area within the ordinary highwater mark) of the South Fork McKenzie River and its banks. For the Hidden Lake-Lulu Lake SIA these areas are the banks and surface waters of Hidden Lake, access trails and the parking area. Within these viewsheds, specific viewpoints that provide longer duration views of the landscape were analyzed. Specific viewpoints were identified such as bridges that cross the South Fork McKenzie River, trails and developed recreation sites.

Viewing scenery from the surface waters and banks of the South Fork McKenzie River is constrained by thick forest and riparian vegetation. Additionally, steep banks and topography further restrict views into the surrounding landscape. Boating use is very low in segment 2 of the river and is restricted to small, non-motorized craft such as kayaks and small inflatables. This section of the river requires advanced river running skills and is often filled with downed trees, further reducing boating use. Because of these constraints, visitors viewing the landscape from within the ordinary highwater mark (from the river) are primarily anglers. Anglers typically wade into the river from access points (often dispersed sites or campgrounds) and wade a short distance upstream or downstream to access fishing spots. The proposed harvest treatments within the South Fork McKenzie River SIA would not be visible from the banks or from the river and are not expected to impact scenic views from these viewing locations.

Proposed harvest treatments would not be visible to forest visitors traveling on Forest Road 19 (West Cascades National Scenic Byway) due to the prevalence of thick, roadside forest which obscures views into the surrounding landscape and general lack of viewing locations (pull-outs) on this narrow, winding section of road. The exception is a unit near the South Fork Bridge at Cougar Crossing Campground. This thinning unit will be visible from the bridge and from the campground but dense forest between Forest Road 420 and the river obscures the view of the lower section of the unit. Two units would be visible to hikers on Frissell Trail and Elk Creek Trail. These units have had design features (Chapter 2) established to ensure consistency with SIA standards and guidelines.

Several units are adjacent to Forest Road 431 which runs roughly parallel to the South Fork McKenzie River on the southern side of the river. This road is currently not accessible due to a road closure but implementation of the Green Mountain Project would open this road to vehicle use. This road is not a primary travel route and units proposed for treatments along secondary forest roads have been addressed in the Scenic Quality chapter (Section 3.10) of this DEIS. Viewing scenery from the surface waters, banks and parking area at Hidden Lake is constrained by thick forest and riparian vegetation. Boating, fishing and sunbathing are popular activities on the lake and the lakes surface and banks are the primary viewpoints into the surrounding landscape.

Please refer to Section 3.10 – Scenic Quality for additional information and analysis of scenery in the Green Mountain project area.

Recreation

A Roaded Natural management allocation applies to both SIA's. This ROS class provides for a desired social setting where there are opportunities to affiliate with others but some chance for privacy. There will be some obvious physical controls in place to protect natural resources however these controls will be consistent with a mostly naturally appearing environment. Effects to Recreation have been analyzed in detail for the Green Mountain project which includes both SIA's in the Recreation chapter of this DEIS (3.9 Recreation). Effects to recreation are the same for both SIA's and there are no anticipated significant long term direct or indirect effects to recreation expected due to the implementation of the Green Mountain project.

Wildlife

Treatments associated with the Green Mountain project would provide a late-successional forest corridor around the South Fork McKenzie River by increasing horizontal and vertical diversity in the SIA. Planned habitat enhancement activities would provide for high quality habitat conditions. By implementing gaps, the project would provide numerous benefits for many species. Gaps provide habitat for shrubland birds not present in mature forest (Chandler et al. 2009) while generally providing more fruit and more resource abundance due to a lower canopy and increased fruiting (Blake and Hoppes. 1986). Generally, gaps provide more resources to herbs, shrubs, and broad-leaved plants which provide the foundation for food webs that contribute to many different trophic levels in Pacific Northwest conifer forests (Hagar, 2007).

Fish

Harvest units were field reviewed by aquatic specialists. Conditions of the Riparian Reserve and stream channel were taken into consideration when developing no-cut buffers, thinning treatments, gap treatments, and areas to "skip" harvest (i.e. no cut areas). These prescriptions along with design features found in Chapter 2 of this document would protect fish and their habitat in the SIAs. Refer to the Hydrology section (Section 3.3) and the Aquatic Resources section (Section 3.4) for additional analysis on the potential effects of this project.

Cumulative Effects

There are no ongoing or reasonably foreseeable projects proposed in the South Fork McKenzie and Hidden-Lulu Lake SIAs. No other past, present, or reasonably foreseeable future actions have effects that overlap in time and space with the actions proposed in the Special Interest Areas with the Green Mountain project. No previous Forest Plan amendments have been approved for programmed harvest in the South Fork McKenzie and Hidden-Lulu Lake SIAs.

3.15 Special Habitat Areas

3.15.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects is the units in the Cascade Special Habitat Area in the Green Mountain project area.

3.15.2 Affected Environment

Special Habitat Areas (SHAs) are land allocations designated in the 1990 Willamette National Forest Plan due to their unique wildlife habitats and botanical sites.

Cascade Special Habitat Area

The Cascade Special Habitat Area (SHA) is located within the Green Mountain project area. The Cascade SHA is approximately 1,225 and designated as Management Area 9d in the Forest Plan with goals to protect or enhance unique wildlife habitats and botanical sites which are components of healthy, biologically diverse ecosystems. The northern edge of the boundary aligns with the Three Sisters Wilderness boundary on Rebel Rock Ridge; the southern boundary follows Forest Road 19. The boundaries of the Cascade SHA are also within the Cascade high emphasis area for elk (designated in the Forest Plan Standard and Guideline FW-135 to FW-153). The overall management emphasis for both the SHA and the high emphasis area for elk are to maintain elk calving refuge, cover, and forage, as well as limit open road densities. This can be maintained by the current gated road closures on the arterial roads within the 9D (1900-455, 425 and 429 roads), as well as providing a mix of habitat types that maintain high quality forage conditions for elk, interspersed with suitable optimal cover which consists of late-successional forest conditions.

3.15.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No timber harvest activities would occur with Alternative 1. The currently dense forest plantations would continue to provide hiding cover for elk, when disturbed or hunted, and some low quality forage. Over the next century or more, these plantations would grow towards older forested habitat conditions while continuing to provide hiding cover and some low quality forage for elk. As the stands naturally self-thin or natural disturbances such as fire creates gaps in the canopy, the emergence of forbs, shrubs, and grasses would provide a slight increase in quality and availability of forage for elk. Without active management or a large natural fire event, these forest stands would not be able to provide the young to mid-seral forest stage habitats that elk rely upon for quality forage that is critical for maintaining and growing healthy and robust elk populations. Recent research by the Starkey Ungulate Team at the PNW Starkey Experimental Forest has shown that nutrition drives everything from reproduction, productivity, recruitment, annual survival, and antler size and form (Cook et al. 2004). Thus, Alternative 1, no action, would not meet management objectives for the 9D SHA, nor would it be consistent with goals outlined for the Cascade high emphasis elk area.

Alternative 2 and 3

Standard and Guideline MA-9d-08 and 09 prohibit scheduling programmed harvest; however, "vegetative treatments, including commercial harvests, should be permitted if necessary to meet established wildlife objectives." Treatments proposed with Alternative 2 and 3 would meet the established wildlife objectives for the Cascade SHA through management activities which would provide canopy openings sufficient in size to increase the quality and quantity of elk forage produced, while maintaining elk calving refuge and cover through retained areas, or skips. The proposed treatments would also provide for development of late-successional forest conditions in these stands, in a timelier manner than compared to no management. The road densities would be maintained under the action alternative as stated above.

Alternatives 2 and 3 would have direct and indirect benefits on elk and their habitat. Alternatives 2 and 3 would harvest the same forest stands and number of acres, thus the effects would be the same. Both alternatives would treat five units in approximately 35-40 year old plantations, with a heavy thin harvest prescription, totaling approximately 74 acres within the Cascade SHA. This harvest would include gaps, which would provide more light to the forest floor than thinning alone, and thus improve conditions for growing high quality elk forage. The resulting early seral habitat conditions would also provide essential habitat features and plants needed by other early-mid-seral dependent (wildlife) species.

Cumulative Effects

Alternatives 2 and 3

The Cascade Thin project harvested about 55 acres with a heavy thinning treatment and 10 acres of gaps, within the Cascade Special Habitat Area in 2013. This led to a slight improvement in forage habitat conditions within the SHA. No other past, present, or reasonably foreseeable future actions have effects that overlap in time and space with the actions proposed in the Cascade SHA with the Green Mountain project.

3.16 Fire and Fuels

3.16.1 Scale of Analysis

Project and stand specific data, as well as landscape level data, were used due to the nature of fire as a natural disturbance and how it moves across the landscape. Stand level information was used to identify and predict specific fuels characteristics and effects.

3.16.2 Affected Environment

Fire on the Landscape

Fire has been a dominant disturbance in the project area. Records indicate 316 fires occurred in the Green Mountain project area from 1970-2013. Due to fire suppression most fires were suppressed at less than five acres within a few days of ignition. Multiple researchers collected past fire data in and near the project area and categorized the fire regime as both mixed and high severity (Tepley et.al. 2013; Means, J. E. et.al. 1996).

Fire regime models (categorized at larger landscape scale than the project area) indicate the project area to be a mixture of Fire Regime (FR) I, III and V, with FR V found at higher elevations. Fire regimes are described below. Figure 39 displays the fire regimes in the project area.

- **Fire Regime I:** < 0 to 35-year fire return interval; low severity
- **Fire Regime III:** < 35 to 150-year fire return interval; mixed severity
- **Fire Regime V:** 150+-year fire return interval; high severity

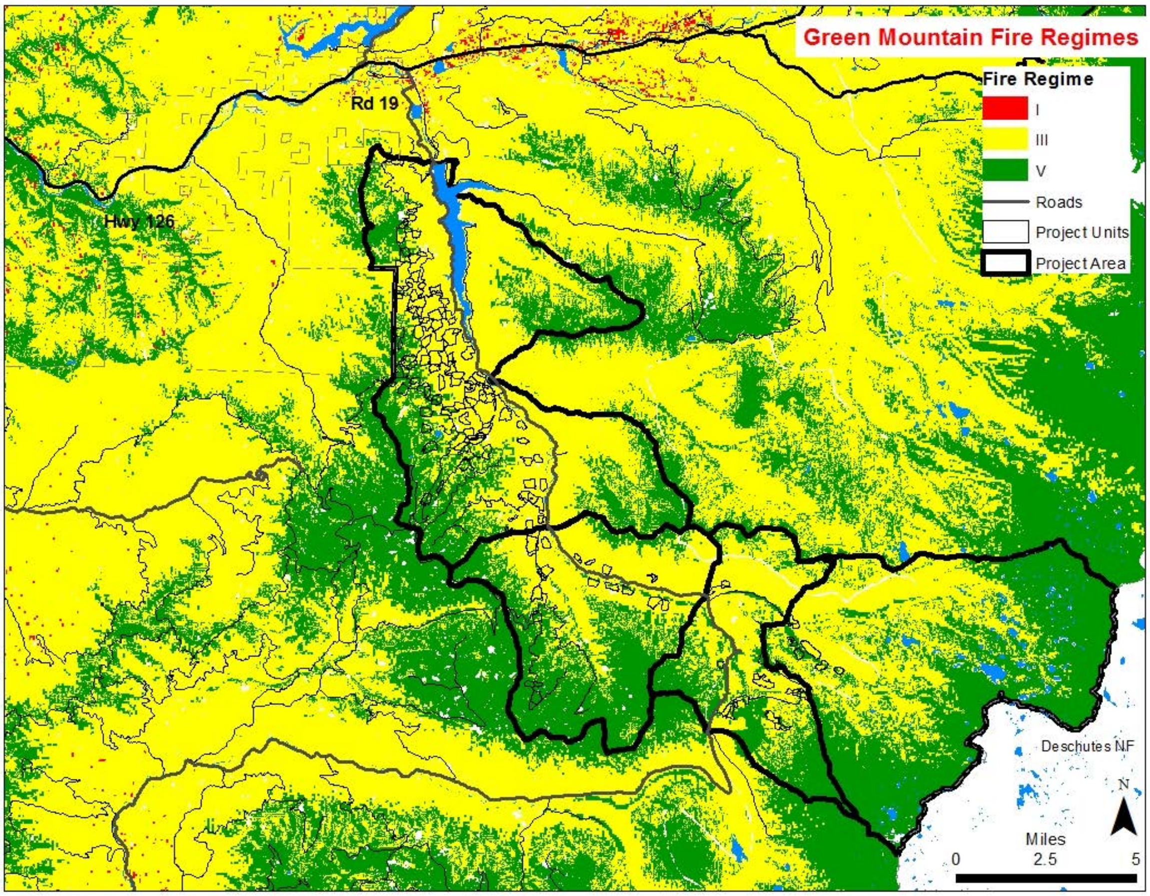


Figure 39. Fire Regimes in the Green Mountain Project Area

Mixed severity fires are not stand-replacing but rather create a patchy mosaic of different mortality (forest structure and diversity) across the landscape (Tepley et.al. 2013; Swanson 2008; Kertis et al. 2007; Weisberg 1998). From an aerial viewpoint the project area would look like a mosaic of different sized patches, from one to hundreds of acres, which have burned within the past 150 years. Some of the locations may just burn in the understory and not affect the canopy, or they may burn in the understory while individual or groups of trees torch. Mixed severity is characterized by varying degrees of fire intensity (heat) given the topography, vegetation, and the ability of trees to withstand the intensity (e.g. thick bark) thus creating different levels of mortality (severity) and wildfire size. With the removal of fire as a natural disturbance process the natural changes to the forest has been affected. Within the project area, Tepley et. al. (2013) conveys that non-stand replacing fires (i.e. fires that kill 70 percent of the overstory [Agee 1998]) have been eliminated, which affects the changes in cohorts over time. For example, within the project area, sugar pine which is shade intolerant has not been able to regenerate due to lack of open spaces which mixed severity fires create.

In addition to the frequency and severity, the departure from historic fire disturbance is categorized into Fire Regime Condition Class (FRCC) (NWCG Glossary). With 100+ years of suppression and forestry land management the key elements of mixed severity regimes are being lost, such as species composition, structural stage, stand age, canopy closure, and fuel loadings (Barrett et al. 2010 and Kertis et al. 2007; NWCG Glossary).

The Green Mountain project area is mostly categorized as a FRCC2, moderately altered from the historical range of variability for fire interval. There is a continued increased hazard of higher severity fire due to the continuity of horizontal and vertical fuels across the area; continuous canopy closure and increased fuel buildup due to fire suppression and human management create more of a potential for unnatural, severe wildfire. With the suppression of the last 300+ wildfires, processes in the forest systems are changing and hazards and risks increase with future wildfires.

Fuel Models

Dead needles, sticks and branches are the fuels that most often carry the fire and are measured by size as it relates to the amount of time for the fuel to dry: 1 hour fuels – 0-.25 inch diameter; 10 hour fuels - .25-1 inches; 100 hour fuels – 1-3 inches (NWCG Glossary). Larger fuels, greater than 3 inches, contribute to residence time and play a role in fire behavior but they are not often used to model fire behavior. One, 10 and 100 hour fuels are those estimated and used in fire behavior modeling and predictions. Most often the dead fuels available during a wildfire or prescribed fire are 1, 10, and 100 hour fuels (0-3 inch diameter) and lichen. One hour fuels fluctuate quickly during the course of a day and when 10 and 100 hour fuels lose moisture fire can move more quickly. Surface fuel loading (the amount of fuels on the ground) and depth correlate to the fire behavior (Brown and Snell 1980). Fuel loading (measured in tons/acre) is used to model fire behavior within the units and varies with different aged stands. Horizontal or surface fuels refer to fuels on the ground, while vertical fuels refer to the ladder fuels such as limbs on the bole of larger trees, brush and younger trees within the stand.

Fuel models are used to quantitatively describe surface fuel loading to calculate predicted fire behavior (Anderson 1982; Maxwell et.al. 1980). Fuel models are a quantitative way to describe surface fuel loading, arrangement, structure, and calculate predicted fire behavior (Maxwell and Franklin 1980). Fuels created post-harvest can be heavy or light given the number of trees cut, the method of harvest, the branch density of the crowns of trees and the amount of branch and top breakage. The fuel models (FM) identified for the project area are:

- FM8 – young stands (20-80 years old) with light fuel loading of approximately 5 tons/acre of 0-3 inch fuels and varying amounts of brush in the understory; low intensity fires with low severity (low mortality of dominant overstory vegetation).
- FM10 – intermediate to older stands (>80 years old) with moderate to heavy fuels on the ground, ladder fuels and lichen in the trees; high fire intensity and severity including crown fire with mortality.
- FM11 – Light slash load resulting from light to moderate partial cuts or harvests which yard tops of trees attached to the last log. Fuel loading in the 0-3” diameter for live and dead fuel is <12 tons/acre. The continuity of the slash can increase fire behavior.

Fire Behavior

Wildfires continue to occur naturally in this area. The Green Mountain project area averages 7.7 wildfires per year. Fire is a dynamic process influenced by fuel loading and multiple environmental factors such as wind, topography, temperature, and humidity and can burn under one or many of these elements. Modeling fire behavior helps to identify fires movement and impacts within the vegetation. Fuel models are used as inputs to the fire behavior models, as well as for firefighter's reference when engaged in a wild or prescribed fire.

Fire behavior was modeled using BehavePlus5 (NWCG Glossary) with fuels and topography inputs that correspond to the Green Mountain project area. Fire weather data used in the model represents actual summer conditions of hot and dry similar to 2010 and 2011. Weather conditions represent events when a wildfires rate of spread can escape initial attack and potentially threaten firefighters, the public, or resources. Firefighter safety is at risk when flame lengths (FL) exceeds the length of hand tools used by firefighters (>4 foot FL) and the rates of spread (ROS) exceeds the ability of firefighters to build handlines. Fire suppression operations would require mechanized suppression resources to safely suppress the fire when the FL or ROS exceed the firefighter's ability to remain safe. Larger fuels, > 9" diameter, are not often thought of as the carrier of fire. Large 1000 hour fuel create longer lasting intensity, higher flame lengths and enable crown and high severity fires to progress. Crown fire creates spotting as the heat from the fire or the wind lofts embers into the air and ahead of the main fire. This increases ROS and severity/intensity as the main fire burns in to the new spots ahead (NWCG).

Table 63. Modeled Wildfire behavior for Green Mountain Units[a]

	Rate of Spread (chains/hour)	Flame Length (feet)	Percent Mortality
Existing conditions inside and outside of units (FM10)	9 ch/hr	8 feet	45 percent
Post-harvest, NO fuels treatment (FM11)[b]	15 ch/hr	8 feet	50-90 percent
Post-fuels treatment (FM8)	3 ch/hr	1 feet	1 percent

a – Prescription parameters used were hot, dry conditions similar to those at the peak of fire season. (80°, 10 mph 20 ft. wind, 1,10,100 hour fuels 4,6,8% fuel moisture).

b – Fuel loading post-harvest can range depending on the method of harvest and would be surveyed or measured prior to fuels treatment.

Another element or fuel that affects wildfire behavior within the project area is lichen. Lichen grows on the boles of trees, and drapes throughout the branches. This fuel dries faster than 1 hour fuels, burns quickly, and carries fire into or through the crowns. When a small fire burns around a tree, lichen can easily carry fire up the bole of the tree into the canopy. Within the canopies fire can move easily from canopy to canopy even during fair weather, i.e. early in the summer season or cooler temperatures as seen on the McKenzie River Ranger District. Because lichen dries quickly and carries fire easily, lichen can foster tree crowns to burn even at the beginning of fire season when the live fuels are high (moisture level of green needles on conifers or brush). Live fuel moistures of herbs, shrubs, and trees decrease through the summer making them more burnable but with lichen the live fuel moisture do not play as big of a role. There are no fuel models representing lichen as a fuel and crown fire can be underestimated but local knowledge offers experience and adjustments to predictions.

Probability of ignition also plays a role when trees are torching or crown fire occurs due to the embers lofted into the air and igniting locations outside of the main fire perimeter. Probability of ignition helps to identify when spotting could become a problem and increase the ROS or add additional hazards during fire management especially if embers land in areas with more available fuel and closed canopy.

With suppression and forest management, wildfires have not played their natural disturbance role on the landscape. The departure from historic conditions affect the current wildfire behavior, fuels and the way forests move through seral stages, stand structure, spatial arrangements, species composition and successional roles. Using prescribed fire for slash reduction can offer changes to aim towards diversity and adding the ecological benefits (Means et.al. 1996).

The data and fuels modeling outputs used for this section can be found in the Green Mountain project record.

3.16.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No post-harvest fuels treatments would occur with Alternative 1. Fire suppression would continue and vegetation would persist through successional pathways with no natural disturbance. Without changes to the structure of vegetation, through thinning and prescribed fire, the project area would continue to lose attributes associated with mixed severity fire regimes, such as structural stage, canopy closure and particular species like sugar pine. Without fire disturbance or changes to stand structure, wildfires would potentially burn more acres due to increases in fuel loading, homogenous stand conditions and ladder fuels if suppression is unsuccessful.

Alternative 2

Harvests created slash on 3,327 acres would increase the fuel loading, especially in the 1, 10 and 100 hour fuels. Following timber harvest the heavy fuel loading can persist about five years with red needles persisting over the first one to two years. Slash is lofty which allows air to funnel through creating a productive burning environment, especially with red needles. The increase in fuels increases the potential for greater or more intense wildfire behavior. During a wildfire the rate of spread (ROS measured in chains per hour which is 66 feet) in slash can be greater than untreated existing conditions.

The proposed fuels treatments in Alternative 2 would reduce harvest created slash through prescribed fire underburns, or hand or machine piling and burning. Harvest created slash would be treated 1-2 years post-harvest. The fuels treatments within each unit would help to improve firefighter and public safety during future wildfires, prepare units for planting, to create snags, help to increase vegetation diversity to the project area and offer a secondary benefit of returning the natural disturbance process of fire. Underburns would return the disturbance that creates changes to the soil, nutrients, vegetation species and regeneration (Swanson 2008) as well as simulate non-stand replacing wildfires (mixed severity) (Tepley 2013, Barrett et al. 2010).

Post-harvest fuel loading was calculated for all units based on the stand exam data. The values are for 1, 10, and 100 hour fuels (0-3 inch diameter fuels) measured in tons/acre and categorized by stand age classes. The average post-harvest fuel loading (without fuel treatments) is 16 tons/acre. Post-fuels treatment fuel loading would meet Design Features (<11 tons/acre). Modeling data was specific to each unit and can be referenced in the Fire/Fuels analysis file. Depending on the amount of trees removed, breakage during harvest and crushing of smaller trees and shrubs the fuel loading in the Green Mountain units range from 6.6 to 40 tons/acre. Prior to burning post-harvest fuels are surveyed to identify the specific amount of fuel.

Fire behavior was modeled for existing fuel models and post-harvest with-and-without fuels treatments (Table 63). Weather parameters used for modeling were hot, dry conditions similar to those during the fire season with temperature of 80°F, 10 mph 20 ft. wind and 1, 10, 100 hour fuels at 4, 6, 8% fuel moisture, respectively.

In the event of a wildfire, fire behavior would be minimized with harvest (reducing canopy continuity) and fuels treatments (reducing fuel bed) by keeping fire more on the ground and not in the canopy thus improving suppression efforts. A more open canopy can allow the sun to quickly heat the vegetation and fuels on the ground, and with fewer trees the potential for wind within the stand can increase. Even though these modifications could result in faster rates of spread during a wildfire they would be lower intensity (heat), duration and lower flame lengths compared to harvested stands with no fuels treatments. The harvest and fuels treatments also reduce ladder fuels (vertical and horizontal fuels) which would reduce the potential for tree torching or crown fire (Safford 2009; Lindh 2003; Agee 2002) reducing spotting in and out of the unit.

Wildfire and prescribed fire are dynamic processes influenced by multiple environmental factors such as wind, topography, temperature, and humidity. Due to these influential factors, which create and alter fire behavior, a chance exists to exceed underburn objective parameters. To reduce these factors, underburns would be conducted during optimal weather and fuels conditions, most likely in the spring or fall. The weather and fuels conditions would be specific to the unit's location and fuel loading. Tempered speeds of ignition would also be identified to reduce mortality of residual canopy. In the event the fire behavior exceeds treatment objectives or burning operations, changes are evaluated immediately and adjustments are made to alter fire behavior. Containing fire in the units is important given firefighter and public safety, private property, project objectives and surrounding natural resources.

Post-harvest underburns may require firelines constructed around the perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Firelines are created around the unit by scraping fuel back to mineral soil (18" line) and scattering fuels that lie within 10 feet of the fireline. If needed, units on steep slopes can have waterbars within the fireline to reduce erosion. Also, firelines are rehabilitated to existing conditions if needed.

Firelines are usually not built along skips or Riparian Reserves (shaded areas). During the post-harvest underburn these areas burn with less intensity due to lower temperatures and higher relative humidity from the thicker canopy cover. Fire often backs into the shade and behavior decreases to a smolder or extinguishes itself.

Hand, grapple, and landing piles are covered with regulatory plastic following construction (Oregon Department of Forestry 1995). This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall, winter or early spring when there is very low risk of fire spreading from the piles. Removing the plastic before burning is suggested in order to aid in reducing emissions from the plastic.

After treatments the fuel profile would aid in protecting private property near the northwest portion of the project area. Fuels treatments next to private property would aid in changing fire behavior moving from the project area to private and vice versa. Again, hazards to firefighters and public, property/structures, and resources would be decreased and suppression tactics and safety would improve. The proposed actions (harvests with fuels treatments) would make steps towards ecosystem diversity by returning the changes fire provides to the forest.

Monitoring for McKenzie River fire and fuels would take place prior to, during and following the fuels treatments. Fuels treatments and data offer information to use in future projects.

Alternative 3

Alternative 3 would have the same effects as Alternative 2 but on fewer acres because 136 fewer acres would be harvested. Fire as an ecological disturbance process in the project area would most likely not occur in these stands given fire suppression. These stands will continue through successional pathways without changes to structural diversity or natural ecological process that would be present with thinning and prescribed fire. All fuels treatments described in Alternative 2 would apply to Alternative 3.

Cumulative Effects

Cumulative effects of the Green Mountain project alternatives were analyzed in the South Fork McKenzie 5th field watershed. Past, present and reasonably foreseeable fuels treatments alter wildfire activity and fuel continuity across the landscape. The Wildfire Risk Reduction Fuels Thinning project is a reasonably foreseeable future actions in the next five years affecting fuels treatments within the watershed. The project aims to reduce the abundance of ladder fuels within road corridors and adjacent to the Three Sisters Wilderness to improve wildfire containment or suppression in the event of a wildfire. Additionally, post-harvest pile burning associated with the Hartz EA would not affect fuels treatment in the Green Mountain Project.

Alternative 1

Because this is no action, there would be no additional impact on the environment from this project when added to the impacts of other past, present, or reasonably foreseeable future actions (40 CFR §1508.7). Fire suppression would continue thereby affecting the changes to the ecosystem with the continued removal of the natural disturbance.

Alternative 2 and Alternative 3

No adverse effects on the fuel profile or on fire behavior would result from the proposed fuel treatments. The proposed actions in Alternative 2 and 3 would change the vegetation structure diversity and return a fire disturbance to the units through prescribed fire. The Hartz units that have been thinned with fuels treatments also add to changes in vegetation structure. The proposed Wildfire Risk Reduction Fuels Thinning project would aid in wildfire suppression efforts along roadsides with the fuels reduction. Given continued fire suppression, all of these projects help to change the vegetation that may have occurred within the natural fire regimes of stand and non-stand replacing fires.

Continued fire suppression and timber management have different effects (on wildlife, habitat, aquatics, soils and vegetation species) than having fire play its natural role. Many documents and researchers speak about the importance of fire in the forest ecosystem. As stated by Teensma (1996), “restoration and maintenance of fire as an ecosystem process is critical to retention of biological diversity and ecosystem sustainability.” Stand replacing and mixed fire severity regimes across the landscape is a component to maintain varying historic pathways (Tepley et al. 2013). Even if wildfire is not the sole disturbance, the thinning and prescribed fire would help to diversify the fuel profile across the landscape and return fires ecological process within the stands. The Green Mountain Project would help fire play a role in aiding the ecosystem processes when being applied to reduce post-harvest fuels.

3.17 Air Quality

3.17.1 Scale of Analysis

The area defined for direct, indirect and cumulative effects analysis is the treatment units in the project area, as well as, the larger landscape where smoke emissions can travel. These are the locations of the Smoke Sensitive Receptor Areas, Class I Airsheds, and local communities. To compare prescribed and wildfire smoke emissions the amount of fuel burned was from a fuels treatment underburn post-harvest and a non-fuels treated post-harvest unit in a wildfire. The model runs used a Douglas-fir vegetation model with slash fuel loading approximately 16 tons/acre.

3.17.2 Affected Environment

Standards for ambient air quality are set by the Environmental Protection Agency (EPA) and are designed to protect human health and welfare. Air quality can be impacted by the presence of particulate matter (and other pollutants) produced by both prescribed burning and wildfire, although smoke from wildfire is considered a natural event by the EPA's Natural Events Policy. Smoke generated from prescribed burning must meet federal and state air quality standards set forth in the 1970 Clean Air Act (CAA section 160).

The State of Oregon has been delegated authority for attainment standards set by the 1990 and 1977 Amendments of the Clean Air Act. To regulate these standards, Oregon developed the Oregon Clean Air Act State Implementation Plan (Oregon Department of Forestry 1995). These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission controls (USDA Forest Service 1990).

Under the Oregon regulations for prescribed fire smoke emissions, visibility and particulate matter (PM) ($PM_{2.5}$ and PM_{10} microns) are measured and regulated in designated areas including Smoke Sensitive Receptor Areas and Class I Airsheds. Priority areas near the Green Mountain Project:

- Smoke Sensitive Receptor Areas (SSRA)
    - Oakridge – 19 air miles southwest
    - Willamette Valley, eastern edge is Deerhorn – 25 air miles west
    - Bend – 40 air miles east
- Class I Airsheds
    - Three Sisters Wilderness – Eastern boundary of project area
    - Mt. Washington Wilderness – 13 miles northeast
- McKenzie River communities (non-designated state areas)
    - McKenzie Bridge – Four miles northeast
    - Blue River – Three miles northwest

3.17.3 Environmental Consequences

Air quality is important and a concern for people and airsheds. During prescribed fire, smoke emissions are short term (1-2 days) and smoke should move through areas of concern during the day. Blue River and other communities along the McKenzie River may receive smoke during the evening hours following the prescribed fires as diurnal wind patterns can carry smoke downhill or down the valley. Class 1 Airshed guidelines would be met and coordinated with the Smoke Management Forecaster.

Direct and Indirect Effects

Alternative 1 (No Action)

If no management actions take place in the Green Mountain project area there would be no air quality impacts from fuels treatments. However, the risk of wildfire would still exist. Air quality impacts from wildfire are considerably higher than they are from prescribed fire. Greater consumption (burning) of debris on the ground and the canopy of trees occurs due to the hot weather and dry fuel. Smoke emissions are not short term and can often last for many weeks or months. The fire continues to spread and smolder in logs and heavy fuel continuing emissions, as demonstrated during Scott Mountain Fire in 2010 and Shadow Lake Fire in 2011. Smoke emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of $PM_{2.5}$ and PM_{10} given the amount of fuel and time the fire burns.

Alternative 2 and 3

Smoke emissions from post-harvest underburns and landing, grapple, or hand pile burning would be mitigated based on the timing of the burns, seasonality, forecasted winds and transport wind direction, and weather. The Oregon Smoke Management Plan requires scheduling prescribed fire on days which are suitable in relation to other Forest Service or private land owners burning, weather forecasts that carry the smoke and location of units to Class I Airsheds and communities. The importance of visibility in Class I Airsheds, such as Three Sisters Wilderness on the east side of the project area, is recognized and burn prescriptions and timing will be designed to minimize potential for smoke intrusion in these areas.

Communities near the Green Mountain project area may be temporarily impacted by smoke from the post-harvest underburns or pile burning. The Oregon Smoke Management Plan states non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon Department of Forestry 1995). However, smoke can settle into the valley during evening inversions and may be of greater amounts than drift smoke which may impact community members who are sensitive to smoke. The time span that smoke is emitted is short (approximately 1 – 2 days) and the impact on community members would be monitored.

The local communities and public would be notified prior to burning. Additional guidance would be calling local community members, posting signs in the community areas, such as grocery stores, and signing along the road or near the treatment area. Prescribed fire notifications and implementation would also be designed to minimize the potential for impact to visitors in these areas within or bordering the project boundary:

- Delta Campground – Three miles north of Cougar Dam
- Terwilliger Hot Springs – along Road 19, three miles south of Cougar Dam
- Cougar Crossing Campground – 4.8 miles south of Cougar Dam
- Box Canyon Campground – 17 miles south of Cougar Dam at the southern boundary of the project area

Based on post-burn data and recon from previous fuels treatment underburns on the McKenzie River Ranger District the average fuels consumed are: 80 percent of the fine fuels 0-1 inch diameter (1 and 10 hour fuels), 40-60 percent of the 1-3 inch fuels (100 hour fuels) and only about 20 percent of the 3-9 inch fuels (1000 hour fuels). The fuel moisture of large woody material (> 9 inches) is too high to burn and only the bark is charred. It is important to note all fuels treatments do not occur as a single event therefore the smoke emissions from all the harvested units do not occur at the same time. Prescribed fire treatments would be one or two underburns or one or two piled units burned in one day and underburning and pile burning usually occur during different seasons. In comparison, during hot, dry weather wildfire emission would occur over several days or months if it escaped initial attack.

Smoke emissions of $PM_{2.5}$ and PM_{10} was modeled and compared between a fuels treatment underburn post-harvest and a non-fuels treated post-harvest wildfire. Results identified wildfire emitting approximately two times more PM during one burn period. The fuels burned during a wildfire are greater as it consumes large woody material and full tree crowns versus prescribed fire burning when less fuel is consumed due to weather conditions and higher fuel moisture. Additionally, wildfires continue to burn with the dry conditions and the majority of the litter and duff are consumed through smoldering which contributes greater amounts of emissions. The comparison for both fires used Douglas-fir forest vegetation classification with slash under weather conditions that characterize the parameters to burn for prescribed (moist) and wildfire (dry). Wildfires are modeled with no suppression, burning for only one burn day using hot, dry conditions.

Cumulative Effects

Alternative 2 and 3

Impacts on air quality from smoke emissions would not exceed state mandated policy. Prescribed fire smoke emissions would be short duration (1-2 days). Prescribed fire burn prescription parameters would reduce the amount of slash burned and the quantity of emissions during the prescribed burns. Because smoke is of short duration and dissipates over the course of one or two days past management activities would not cumulatively add to air quality impacts from the proposed treatments.

The Three Sisters Wilderness Wildfire Risk Reduction Fuels Treatment project is proposed within the Green Mountain project area over the next 5 years. The fuels treatments would be cutting, piling and burning trees less than 10 inches diameter breast height 150 feet off of Roads 1900, 1900500, 1964, 1958 and 1958310. Other similar fuels treatments outside of the project area (Bridge EA, Goose EIS, Horse Creek EA and 13 Thin CE) may also contribute to smoke emissions if treatments occur within a day or two of Green Mountain fuel treatments. Approval to burn one or multiple units (underburns or piles) would need to be approved by Oregon Smoke Management.

If two units are being burned in or outside of the project area in one day or multiple burns (private land or Forest Service) smoke management forecasters coordinate with other land agencies or owners so air quality can be monitored and treatments delayed in order to maintain acceptable air quality. This coordination would ensure this project meets guidelines and regulations through Oregon DEQ. No other foreseeable management activities would affect air quality or scheduled to occur in the Green Mountain project area or surrounding areas that could affect communities or wilderness.

Past management activities do not cumulatively add to air quality impacts from the proposed treatments.

3.18 Climate Change

Alternative 2 would treat approximately 4,398 acres in the project area. Harvest treatments proposed include commercial thinning, dominant tree release, gap creation, regeneration harvest and skips. Fuels treatments include mechanical treatments and post-harvest underburn.

Climate change is a global phenomenon because major greenhouse gasses (GHG) mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of GHG in 2010 was estimated at 49 ± 4.5 gigatonnes globally (IPCC 2014) and 6.9 gigatonnes nationally (US EPA, 2015), a project of this magnitude makes an infinitesimal contribution to overall emissions. Therefore, at the global and national scales, the proposed action's direct and indirect contribution to greenhouse gasses and climate change would be negligible. In addition, because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas emissions came from several sectors:

- Industry, transportation, and building – 41%
- Energy production – 35%
- Agriculture – 12%
- Forestry and other land uses – 12%

The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000). The Green Mountain project does not fall within any of these main contributors of greenhouse gas emissions. Forested land would not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports trees, and sequesters carbon long-term. US forests sequestered 757.1 megatonnes of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA, 2015). There is agreement that the forestry sector contribution has declined over the last decade (IPCC, 2014; Smith et al., 2014; FAOSTAT, 2013).

However there is growing concern over the impacts of climate change on US forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western United States. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which will have major effect on these forests' role in the carbon cycle (Joyce et al. 2014).

The project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce et al. 2014). Here specifically, the project proposes to improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release. Thinning the overstocked stands would make more growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards larger diameter stands. The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar et al. 2007). This project is also consistent with options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation. Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith et al. 2014). Alternative 2 is consistent with these recommendations because it would improve stand conditions, diversity, density and structure, allowing the forest to adapt, persist and function better over time and into the future.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. Alternative 2 falls into this category.

3.19 Economics

3.19.1 Scale of Analysis

The scale used to evaluate Economics associated with the Green Mountain project is Lane County Oregon. The project lies entirely within the county and funds generated would contribute towards county payments. A majority of the purchasers who participate in timber sales on the McKenzie River Ranger District have offices and/or manufacturing facilities in Lane County.

3.19.2 Affected Environment

The Green Mountain project area is situated along National Forest Road 1900, Aufderheide Drive, south of Highway 126 between the communities of McKenzie Bridge and Blue River, Oregon. Highway 126, a major travel route for commercial and recreation traffic passing through this community, follows along the McKenzie River.

The economy of the local communities from the Springfield urban-growth boundary to McKenzie Bridge depends on a mixture of tourism, recreation, timber industry, and Forest Service jobs for stability. Local businesses that rely on tourism and recreation include: multiple inns and lodges, restaurants, stores, and gas stations, along with outfitters and guides. Forest industry jobs include the obvious logging and mill jobs, but also includes other natural resource specialist like wildlife biologist, botanist, hydrologist, archaeologist, and fisheries biologist. Tourism and recreational activities connected with National Forest lands have been on the increase in recent years for the upper McKenzie River area. Employment connected with tourism and recreation-related services has also increased.

The current level of timber harvesting on the Willamette National Forest has dropped substantially from the levels of the mid-1980s. This decrease has contributed to a decline in the number of local jobs associated with the wood products industry and jobs which are dependent on other industries to spend money. The economic impacts of forest sector jobs contribute approximately 5.4 percent, or 6,595 jobs to Lane County, in addition to approximately 11.5 percent or $1.2 billion to the county’s economic base (OFRI 2012, pg. 55), and the same OFRI report states on pg. 41, that approximately 10.8 jobs are created with each incremental increase in million board feet made available for harvest. These jobs are direct effect jobs, or those associated in the harvest, indirect effect jobs, or those businesses that supply goods associated with harvest, and induced effect jobs, or those who work in the broader economy who benefit when people with direct or indirect jobs spend money (OFRI 2012, pg. 21).

3.19.3 Environmental Consequences

Direct and Indirect Effects

The direct economic effects of the alternatives are displayed in Table 64. A standard criterion for deciding whether a government program can be justified on economic principles is present net value (NPV) – the discounted monetized value of expected net benefits (OMB A-94). Another standard criterion for economic efficiency is the benefit/cost ratio (B/C ratio) which is the product of the present value of benefits divided by the present value of costs.

Alternative 1

The no action alternative would not harvest any timber, and therefore, would not support direct, indirect, and induced employment. It would not result in increased income to the regional or local economy (including the counties). Current levels of employment in the wood products sector would not change under this alternative. If the Green Mountain project were not replaced by another project, the no action alternative could contribute to a continued decline in forestry and milling related jobs.

Alternative 2 and 3

Alternatives 2 and 3 are economically viable, considering current selling values, timber volume per acre, yarding systems required, the proposed temporary road construction and system road maintenance needed, and the identified post-timber harvest projects identified in this analysis. The economic analysis utilized to make this determination is available in the Green Mountain project record at the McKenzie River Ranger District office. Based on the expected return to the Federal government plus the value of restoration activities potentially funded by stumpage shown in Table 64, Alternatives 2 and 3 would provide a beneficial benefit/cost ratio.

In general, the primary effect on timber harvest-related employment would occur from commercial timber harvest associated with the action alternatives from an estimated selling year of 2018 through a final harvest year of 2025. As Table 64 indicates, both action alternatives would provide some opportunity for timber harvest-related employment, and higher revenues. Alternative 2 would provide a higher net value than Alternative 3. Table 64 below discloses costs and revenues and the estimated present net value of each of the action Alternatives.

Though the combined economic benefit from implementation of any of the action Alternatives is expected to be positive, each of the Alternatives from the Green Mountain Project would have a localized beneficial effect for the socio-economic environment of western and central Oregon with a greater impact to Lane County. Both action Alternatives would also have a benefit in the form of revenues going towards the National Forest Fund (NFF). Portions of revenue generated by the sale of timber from the action Alternatives would be available to the county for roads and schools. Alternative 2 would be expected to generate approximately twice the revenue generated with Alternative 3.

Table 64. Estimated Economic Alternatives [1, 2]

	Alternative 1	Alternative 2	Alternative 3
Net Timber volume produced (MMBF)	0	~ 66	~ 51
Discounted Cost	$0	$30,600,097	$25,071,242
Discounted Revenues	$0	$36,074,207	$27,634,694
Net Present Value (NPV)	---	$5,474,110	$2,563,452
NPV per acre	---	$1,663	$867
Benefit/Cost Ratio	---	1.18	1.10

1 - Revenue based on the 2015 4st quarter Oregon Department of Forestry pond values that have been discounted at 4 percent from 2015 until implementation.

2 - All values are for comparative purposes only. Actual values will be dependent on market values during time of sale and cost of associated activities at that time.

Cumulative Effects

Alternative 2 and 3

Neither action alternative will have any economic cumulative effects, because there is no overlap in space and time with effects from any past, present or reasonably foreseeable future actions.

3.20 Unavoidable Adverse Impacts

Implementation of any of the alternatives, including the No-Action alternative, would inevitably result in some adverse environmental effects. The severity of the effects would be minimized by adhering to the direction in the management prescriptions and Standards and Guidelines in Chapter IV of the Willamette Forest Plan, as amended the Northwest Forest Plan, and additional design features proposed in Chapter 2 of this document. These potential adverse environmental effects are discussed at length under each resource section.

3.21 Irreversible and Irretrievable Commitments of Resources

“Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An "Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource uses.

The soil and water protection measures identified in the Forest Plan Standards and Guidelines, design features in Chapter 2, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management actions.

Concerning threatened and endangered plant, wildlife, and fish species, a determination has been made that the proposed actions would not result in irreversible or irretrievable commitment of resources that foreclose formulation or implementation of reasonable or prudent alternatives.

With all action Alternatives (2 and 3): Tree removal would result in an irretrievable loss of the value of removed trees for wildlife habitat, soil productivity, and other values. Little irreversible loss of soil should occur due to extensive design features associated with timber harvest and prescribed fire (tractor harvest only on slopes less than 35 percent, skyline yarding with partial or full suspension to meet Forest Plan Standards and Guidelines, etc.).

3.22 Short-Term Effects versus Long-Term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR §1502.16). This includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requires of present and future generations of Americans (42 CFR § 101(a)).

The Forest Plan establishes a sustained yield of resource outputs while maintaining productivity of resources. The specific direction and mitigation measures included in the Forest Plan and Northwest Forest Plan ensure the long-term productivity of resources will not be impaired by the application of short-term management practices. Additionally, project Design Features (Section 2.6) were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices.

Chapter 4 – List of Preparers

Bonny Hammons - Hydrologist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Hydrology Analysis
Education / Experience: B.A. Forestry, minor Environmental Ethics: Humboldt State University. Seven years of experience with the USFS (Lassen, Willamette) as a hydrologist.

Burtchell Thomas – Botanist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Botanical Resource Analysis
Education / Experience: B.S. Environmental Biology, minor Botany (1996): University Arkansas – Pine Bluff. 16 years of experience with USFS (Jefferson-Washington, Okanogan-Wenatchee, Gifford Pinchot, Willamette) as botanist and biological science technician.

Cara Kelly – Archeologist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Heritage Resources Analysis
Education / Experience: B.S. Anthropology: University of Oregon, MAIS, Anthropology, B.S. Geography: Oregon State University. 26 years of experience with the USFS (Willamette) as an archeologist.

Doug Shank – Forest Geologist
USDA Forest Service, Willamette National Forest,
Contribution: Soils Analysis
Education / Experience: B.S. Geology: Youngstown State University, M.S. Geology: Arizona State University. 35 years of experience with the USFS (Willamette, Siuslaw) as an engineering geologist, district ranger, district geologist and forest geologist.

Dave Sanders – Recreation Planner
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Recreation, scenery and Wilderness analysis
Education / Experience: B.S. Natural Resources Management: University of Alaska, Fairbanks. One year as Wilderness Sea Kayak Ranger on Tongass National Forest; 10 years as Wilderness Ranger Program manager for Chugach National Forest; four years as Developed and Dispersed Recreation Program Manager.

Elysia Retzlaff – NEPA Planner
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Project Lead, Writer/Editor, NEPA compliance
Education/Experience: B.S. Geography and GIS: University of Utah, Master of Natural Resources: Utah State University, NEPA Certification: Utah State University. Five years of experience with USFS (Chugach, San Juan, Willamette) as Planning and NEPA Coordinator.

Günther Castillon – Forest Silviculturist
USDA Forest Service, Siuslaw National Forest,
Contribution: Team Lead until June 2014
Education / Experience: B.S. Natural Resources Management, Forest Science: University of Wisconsin-Madison. Two years Project Manager, Willamette National Forest; five years Assistant Forest Silviculturist, Rogue River –Siskiyou National Forest; four years Silviculturist, Huron -Manistee National

Forest; one year Forester, Huron-Manistee National Forest; one year Forester, Green Mountain – Finger Lakes National Forest; two years Research Assistant, Forest Ecology and Management Laboratory.

James Rudisill – Certified Silviculturist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Forest and Stand Structure Analysis, Economic Analysis
Education / Experience: B.S. Natural Resources: Humboldt State University. 11 years of experience with USFS (San Bernardino and Willamette); three years private forestry; two years technical manager Environmental Systems Resource Institute (ESRI).

Jessica Dole – Forest Landscape Architect
USDA Forest Service, Siuslaw National Forest
Contribution: Scenic Analysis
Education / Experience: B.S. Environmental Studies: University of Oregon; Master of Landscape Architecture: Cornell University; Registered Landscape Architect: State of Oregon. 26 years of experience with USFS as a landscape architect (Klamath, Okanogan, and Siuslaw).

Kate Meyer – Fisheries Biologist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Fisheries Analysis
Education / Experience: B.S. Environmental Studies: Southern Oregon University; Professional Certificate in River Restoration: Portland State University. Eight years of experience with USFS (Willamette) in fisheries biology.

Kenny Gabriel – Civil Engineering Technician
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Roads and Access Analysis
Education / Experience: Certificate of Completion in Technical Drafting: Lane Community College. 15 years of experience with USFS (Willamette) in civil engineering/ transportation and 10 years of experience with USFS (Willamette) in road maintenance.

Mei Lin Lantz – Fire and Fuels Specialist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Fire and Fuels, and Air Quality Analysis
Education / Experience: B.S. Forestry: University of California Berkeley. 16 years' experience with USFS (Umatilla, Siuslaw, Ochoco, Willamette); as a firefighter and fire and fuels management.

Ramon Rivera –Fisheries Biologist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District,
Contribution: Fisheries Analysis
Education / Experience: Bachelor of Science in Agriculture (1990) with a double major: Fisheries Science and Wildlife Science and a minor in Biology. Diploma from New Mexico State University. Served 10 years on the Siskiyou National Forest as a District Fish Biologist and 17 years on the Willamette as a District Fish Biologist.

Ruby Seitz – Wildlife Biologist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District,
Contribution: Wildlife Analysis
Education / Experience: B.S. Wildlife Management, Minor in Fisheries: Humboldt State University, B.A. Liberal Studies: San Diego State University. 25 years of experience with USFS (Willamette) as a wildlife biologist.

Chapter 5 – List of Agencies, Governments, Organizations, and Individuals Given Notice of Availability

The agencies, governments, organizations, and individuals listed below were notified of the availability of the Draft Environmental Impact Statement (DEIS). A complete list of recipients, including names and contact information, is available in the Green Mountain project file at the McKenzie River Ranger District.

Agencies and Governments

Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz Indians
Confederated Tribes of Warm Springs
Eugene City Council
Eugene Water and Electric Board
Klamath Tribes
Lane County
Linn County
Office of Congressman Peter DeFazio
Office of Senator Jeff Merkley
Office of Senator Ron Wyden
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
Oregon Department of Parks and Recreation
Springfield City Council
United States Environmental Protection Agency
United States Fish and Wildlife Service

Organizations

American Forest Resource Council
Cascadia Wildlands Project
Forest Conservation Council
Forest Issues, Many Rivers Group, Sierra Club
Giustina Land & Timber
Giustina Resources
Lane County Audubon Society
McKenzie Clearwater Coalition
McKenzie Flyfishers
McKenzie River Chamber Of Commerce
Mule Deer Foundation
Native Forest Council
North American Butterfly Association
Obsidians
Oregon Council, Federation of Flyfishers
Oregon Hunters Association
Oregon Nordic Club, Willamette Chapter

Oregon Society of American Foresters
Oregon Wild
Pacific Crest Trail Association
Quail Unlimited
River Reflections
Rocky Mountain Elk Foundation
Rosboro Lumber Co.
Santiam Wilderness Committee

Individuals

Over 1,400 people, including interested parties, stakeholders, landowners, and individuals that provided comments during project scoping have been notified of the Notice of Availability and the DEIS 45-day comment period. A complete list of recipients, including names and contact information, is available in the Green Mountain project file at the McKenzie River Ranger District.

Appendix A – Compliance with Laws, Regulations and Executive Orders

The National Environmental Policy Act (NEPA), 1969 – NEPA establishes the format and content requirements of environmental analysis and documentation. Preparation of the Green Mountain DEIS was prepared in full compliance with these requirements.

The National Forest Management Act (NFMA), 1976 –All proposed timber harvest units are planned to occur on suitable land. If regeneration harvest is implemented the sites would be capable of restocking within 5 years of harvest by either natural or artificial means. All units were considered for potential uneven-aged management. Proposed commercial thinning would increase the rate of growth of remaining trees. Some locations would favor species or age classes most valuable to wildlife. The resultant reduced stress on residual trees would make treated stands less susceptible to pest-caused damage. Design features have been identified to protect site productivity, soils, and water quality.

All proposed activities would provide sufficient habitat to maintain viable populations of fish and wildlife. Critical habitat for threatened or endangered species would be protected through avoidance. The action alternatives would accelerate development of forest habitats that are currently deficient within the analysis area to enhance the diversity of plant and animal communities in the long-term. See discussions under the applicable resource sections above, for further support that proposed activities that would comply with the seven requirements associated with vegetative manipulation (36 CFR 219.27(b)), riparian areas (36 CFR 219.27(e)), and soil and water (36 CFR 219.27(f)).

Forest Plan Consistency – Actions analyzed in the Green Mountain project are consistent with a broad range of Forest Plan Standards and Guidelines that have been discussed and disclosed throughout the document. The timber stand treatments associated with the project are consistent with the goals and management direction analyzed in the Willamette National Forest Land and Resource Management Plan FEIS and Record of Decision. Road improvements are designed to be consistent with the 1994 Northwest Forest Plan amendments to the Forest Plan and the Aquatic Conservation Strategy objectives.

Northwest Forest Plan Aquatic Conservation Strategy - The Aquatic Conservation Strategy (ACS) is an integral part of the Northwest Forest Plan and was developed to maintain and restore the ecological health of watersheds and aquatic ecosystems on public lands through implementation of four components: 1) Riparian Reserves 2) key watersheds 3) watershed analysis 4) watershed restoration. Based on the analysis presented in this DEIS and Appendix E, the ACS Objectives would be met in each alternative.

The Preservation of Antiquities Act, June 1906 and the National Historic Preservation Act, as amended, October 1966 – Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the foremost legislation governing the treatment of historic properties (a.k.a. heritage or cultural resources) during project planning and implementation. Other legal framework considered the effects of its actions on heritage resources is listed below:

- 36 CFR800 (Protection of Historic Properties),
- 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places), and
- 36 CFR 296 (Protection of Archaeological Resources), and
- Executive Order 13007 – Sacred Sites

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project.

In accordance with this PA, an appropriate inventory was conducted in 2011 and 2012. All known cultural sites in the Area of Potential Effect (project area) were protected by avoidance, resulting in a determination of “Historic Properties Avoided” on June 27, 2013. SHPO concurred with the Forest Service finding on January 27, 2015. Documentation has been retained in the Forest and District Heritage files.

Clean Air Act Amendments, 1977 – The alternatives are designed to meet the National Ambient Air Quality Standards through avoidance of practices that degrade air quality below health and visibility standards. This project is consistent with by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments (See Section 3.16 and 3.17).

The Clean Water Act, 1987 – This act establishes a non-degradation policy for all federally proposed projects. Compliance with the Clean Water Act would be accomplished through planning, application and monitoring of Best Management Practices (BMPs). Based on the analysis presented in this DEIS, TMDL requirements for the McKenzie Basin would be met in each alternative (See Chapter 3.3).

The Endangered Species Act (ESA), December 1973 – The ESA establishes a policy that all federal agencies would seek to conserve endangered and threatened species of fish, wildlife and plants. Biological Evaluations for plants and wildlife have been prepared, which describes possible effects and impacts of the proposed actions on sensitive, and other species of concern that may be present in the project area. A Biological Assessment (BA) was prepared for the northern spotted owl, and for bull trout, and spring Chinook salmon.

Endangered Species Act (ESA) informal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon and Columbia River bull trout is currently in progress. The Biological Evaluation prepared for the Green Mountain project found that the project “may affect, and is likely to adversely affect” Upper Willamette spring Chinook salmon and bull trout. This analysis also found that there would not be any adverse modification of designated critical habitat for either species. On October 14, 2014, the Green Mountain project was presented to the USFWS and NMFS and they concurred with the effects determination of “may affect, is likely to adversely effect.” A Biological Assessment is currently being prepared to enter into formal consultation with USFWS and NMFS. Consultation will be completed prior to publication of the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Green Mountain project. The Forest Service will be required to comply with the terms and conditions provided by the USFWS and NMFS in the Biological Opinion.

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl was completed in 2012 and evaluated by the USFWS in the FY2013 Biological Opinion (FWS reference 1EOFW00-2012-F-0158) signed October 29, 2012. Conferencing was conducted on Proposed Revised Critical Habitat and effects to northern spotted owls (USDA Forest Service 2012). After the final revised Critical Habitat was determined, USFWS conferred that the Conference Opinion was the Biological Opinion for the purposes of consultation on revised Critical Habitat for the Green Mountain Project (FWS reference: 01EOFW00-2013-TA-0034), signed January 3, 2013.

Green Mountain Project	May Affect and Likely to Adversely Affect the Northern Spotted Owl due to Habitat Modification from Shelterwood Harvest with Reserves and Thinning in Suitable Owl Habitat. Incidental Take to 2 potential owl sites.
Green Mountain Project	Not Likely to Jeopardize the Continued Existence of the Spotted Owl
Commercial Thinning in Critical Habitat (dispersal habitat)	May Affect, Not Likely to Adversely Affect, mostly Beneficial Effects on Future Foraging and Nesting/Roosting Habitat in Critical Habitat
Commercial Thinning in Critical Habitat with 52 acres of gaps	May Affect and Likely to Adversely Affect Critical Habitat
Effects due to Disruption	May Affect and Likely to Adversely Affect. Disruption due to Helicopter Logging to 3 Owl Sites (2 are Likely to Adversely Affect, 1 is Not Likely to Adversely Affect due to increased distance to Owl Site)

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – Essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams (Cougar Dam in the South Fork McKenzie River; and Blue River Dam), and natural migration barriers. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for essential fish habitat that requires Federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect essential fish habitat. Essential fish habitat for the Pacific coast salmon fishery means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The species designated in the McKenzie River is spring Chinook salmon.

Technically the South Fork above Cougar Dam is not considered EFH but since reauthorization of the act the USACE has constructed an adult fish collection facility and is actively transporting Chinook salmon above the dam. Therefore, the South Fork upstream of Cougar Dam is considered EFH by the Forest Service. This project would not adversely affect EFH because of the no cut buffers established along fish bearing streams, project design measures, and the implementation of Best Management Practices (BMPs).

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164. Development of Rock Quarries would conform to the requirements of the act, which sets forth mandatory safety and health standards for each surface metal or nonmetal mine. The purpose for the standards is to protect life by preventing accidents and promoting health and safety.

Inventoried Roadless Areas and Wilderness – Wilderness and Inventoried Roadless areas are both located in the project area, however, no actions will occur in these areas.

Prime Farmland, Rangeland, and Forestland – No prime farmland, rangeland, or forestland occurs within the project area.

Survey and Manage Species – The action alternatives comply with the Northwest Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Pre-disturbance surveys were conducted and site management applied consistent with the January 2001 species list.

Management Indicator Species (Aquatic) – The Willamette Forest Plan recognized anadromous and resident salmonids as economically important species and designated them as management indicator species for riparian habitat and water quality. Salmonid fish are good indicators because they are predators in the stream ecosystem. This means that they are not only affected by the physical conditions of their habitat but also by the metabolic energy pathways in the watershed from primary production to decomposition. The most common salmonid sport fish for which there is habitat on the McKenzie River Ranger District are spring Chinook salmon, bull trout, rainbow trout, and coastal cutthroat trout. The Green Mountain Project would maintain habitat conditions for aquatic management indicator species in the project area. Therefore, the Green Mountain Project would not contribute to a negative trend in viability on the Willamette National Forest for these management indicator fish species.

Management Indicator Species (Terrestrial) – The Willamette Forest Plan recognized elk and deer as economically important species that are commonly hunted, and designated them as management indicator species for winter range. Designated management indicator species for old growth and mature conifers are pileated woodpecker, marten, and northern spotted owl. The bald eagle was selected as a management indicator species for old growth conifers near large bodies of water, and the peregrine falcon was selected as a management indicator species for cliff nesting habitat. The Green Mountain project would maintain habitat conditions for elk, deer, pileated woodpeckers, marten, bald eagles and peregrine falcons in the project area. The Green Mountain project would not contribute to a negative trend in viability for any of the terrestrial wildlife management indicator species.

Sensitive Species (Aquatic) - The biological evaluation found that the Green Mountain Project may have beneficial impacts to listed caddisflies. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.

Executive Orders 11988 and 11990: Floodplains and Wetlands – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Proposed harvest treatments would not occur within 100-year floodplains. Executive Order 11990 requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside riparian areas, seeps, springs, and other wet habitats exist in the project area. These areas would be either avoided, or managed according to the amended Willamette Forest Plan Standards and Guidelines. Riparian Reserves would also be protected with design features. As a result, proposed treatments would be consistent with Executive Orders 11988 and 11990.

Executive Order 12898: Environmental Justice – Executive Order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of agency operations. With implementation of either action alternatives, there would be no disproportionately high and adverse human health or environmental effects on minority or low-income populations. Nearby communities would mainly be affected by economic impacts connected with contractors implementing harvest, road reconstruction, tree thinning, planting, and other fuels treatment activities. Racial and cultural minority groups could also be prevalent in the work forces that implement activities. Contracts contain clauses that address worker safety.

Executive Order 12962: Recreational Fishing – The June 7, 1995, Executive Order requires government agencies to strengthen efforts to improve fisheries conservation and provide for more and better recreational fishing opportunities, and to develop a new policy to promote compatibility between the protection of endangered species and recreational fisheries, and to develop a comprehensive Recreational Fishery Resources Conservation Plan. Proposed activities in the project area would promote the restoration of riparian function in stands in corridor and headwater aquatic reserves and to develop additional large wood to stream reaches that currently lack adequate amounts. This would improve fish habitat and would provide better future fishing opportunities for the public.

Executive Order 13186: Migratory Birds – Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U. S.C. 703-704). The U.S. Fish and Wildlife Service is the lead federal agency for managing and conserving migratory birds in the United States. However, under Executive Order (EO) 13186, all federal agencies are charged with the conservation and protection of migratory birds. A Memorandum of Understanding (MOU 2008) between the Forest Service and U.S. Fish and Wildlife Service requires, during NEPA planning, that the FS, to the extent practical, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the FS to consider approaches, to the extent practical, for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled some information to assist biologists in disclosing effects to avian species during NEPA planning (Forest Service and Bureau of Land Management 2013). Effects to FS sensitive birds, federally ESA listed birds, birds that are Management Indicator Species and migratory bird species that have been identified by USFWS as Species of Conservation Concern in the Northern Pacific Forest (USFWS 2008) and that have habitat in the proposed treatment units are addressed in Chapter 3.

Seasonal restrictions are recommended in the Green Mountain Design Features (Chapter 2) to conduct hazard tree falling outside the critical nesting season, as well as tree felling, yarding and prescribed unit underburning on specific units to protect owls. This would minimize disturbances to nesting migratory birds and reduce the likelihood of harm to individual birds. Design features to retain existing snags where possible, and to retain live trees, create snags, and fall trees for dead wood sources would provide structural features migratory birds would use. There is a Design Feature (Chapter 2) to consider late winter or fall for prescribed underburning which would reduce impacts to nesting birds and their young.

Executive Order 13443: Facilitation of Hunting Heritage and Wildlife Conservation – August 17, 2007, Executive Order requires Federal agencies "to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat." The proposed creation and enhancement of early seral habitat in both action alternatives in the project area would improve forage for game species and provide better hunting opportunities for the public.

Other Jurisdictions – There are a number of other agencies responsible for management of resources within the project area. The Oregon Department of Fish and Wildlife is responsible for management of fish and wildlife populations, whereas the Forest Service manages the habitat for these animals. The Oregon Department of Fish and Wildlife has been contacted regarding this analysis and Brian Wolfer, a biologist with the agency, attend a 2014 public meeting.

Proposed harvest treatments within riparian areas have been designed to comply with "Sufficiency Analysis for Stream Temperature – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI BLM, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in a

“Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations” (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry, and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning would comply with the State of Oregon's Smoke Management Implementation Plan and, for greater specificity, see the memorandum of understanding mentioned above.

Energy Requirements and Conservation Potential – Some form of energy would be necessary for projects requiring use of mechanized equipment. Commercial thinning and some partial cutting units would involve both heavy and small machines for yarding logs during the implementation period. Projects such as road reconstruction and maintenance could require heavy machinery for a small amount of time. Both possibilities would result in minor energy consumption. Alternatives that harvest trees could create supplies of firewood as a by-product, which would contribute to a supply of energy for the local community for home heating.

Appendix B – Proposed Treatment Descriptions for the Action Alternatives

Proposed treatments for the Green Mountain project area are thinning, gaps, skips, Dominant Tree Release (DTR), regeneration harvest, and various post-harvest fuels reduction treatments.

Activities Common to Thinning

Thinning would maintain/increase the health and vigor of the remaining trees not harvested. Skips and openings ranging between 1/4-3 acres (see Gaps, and DTR description below) would be placed in many of the stands to promote vertical and horizontal diversity (see Appendix C for a unit by unit prescription). The use of skips and gaps would be part of an un-even aged management approach. Un-even aged management, which is a stand ultimately with more than one age class, would not be applied to all stands; some may not contain any gaps.

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees. Sugar pine and white pine would not be removed from the stand; however they may be cut for operational purposes. Generally, remnant large woody debris on the forest floor would be maintained or increased throughout the stand. Snags would be maintained on site if not a hazard to logging operations.

Project generated fuels may be removed with treatments such as yarding tops attached during harvest, biomass utilization, piling and burning, underburning, mastication, firewood collection, or chipping. However, not every acre harvested would have fuels treatments prescribed. Areas which are projected to be below the standards and guidelines (FW-212 and 252) presented by the Forest Plan would likely have minimal fuels treatments prescribed. All post-harvest fuels treatments would reduce fuel loads within the stand.

Activities Common to Gaps and Regeneration Harvest

Retention trees would be left (see description below for specifics) in openings to function as legacy trees that would benefit a variety of resources. Live retained trees would be released for several reasons including aesthetics, to encourage large tree development, future snag creation, diversity in future stand structure, and development of future large down woody debris.

Retention trees may be spaced both sparsely throughout the opening and also in clumps, increasing the diversity across the landscape. Emphasis would be placed on retaining multiple desired retention tree species where feasible. Live trees with ‘elements of wood decay’ may be selected as retention trees, which could include trees with features like dead tops, broken tops and heart rot. This would increase the diversity of the prescriptions across the landscape.

Live retention trees may or may not be used as snag (wildlife) enhancement projects; however, retention trees meeting criteria for wildlife trees (i.e. having Phellinus pini conks or other elements of wood decay) would serve as a wildlife tree and offset the need for further enhancement. In stands where snags or down woody material would be created after harvest, additional trees may be left that can be utilized. Snags would be maintained on site, if not a hazard to logging operations.

Thinning Descriptions

Thinning: Thinning treatments would reduce canopy cover within a stand between approximately 30-60 percent. The residual stand, post-harvest (not including gaps put in the stand), would have approximately 25-55 percent of the maximum Stand Density Index (SDI) (see Chapter 3.1for discussion on SDI). The prescription aims to stay below 55 percent SDImax, which is where inner tree mortality likely begins to occur (Tappeiner et al. 2007). Gaps, dominant tree releases, as well as skips (areas not harvested) would likely be placed in the stands being commercially thinned.

Thinning would increase the health and vigor of the remaining trees and help increase the stands ability to adapt to environmental changes. Additional light, from reduced canopy cover, reaching the forest floor would help promote a second cohort of trees. Both shade-tolerant and intolerant species may be established; however, shade-tolerant species would thrive over time as the overstory crown closes. The canopy cover is estimated to increase 2 percent per year (Chan, 2006). This second generation of trees growing under the overstory canopy is expected to provide vertical, horizontal, age, and species diversity in the stand by primarily harvesting Douglas-fir which is over represented in the project area because of planting densities.

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees with an emphasis on retention of sugar pine and white pine; however these species may be cut for operational purposes. This prescription would also maintain or increase vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Thinning provides growing space for new trees to increase age, size and height diversity in a stand and at the project area scale. Young uniform stands such as the plantations and many natural stands proposed for treatment in the Green Mountain project can be diversified with early thinning by allowing new generations of trees to establish. Early commercial thinning has been shown to be beneficial to the future development of understories, the promotion of natural regeneration, and in enhancing biodiversity (Muir et al 2002). With early thinning, overstory trees can develop deep canopies and large-diameter branches in open stands (McGuire et al 1991). Low overstory density facilitates the establishment of understory trees (McGuire et al 1991, Bailey and Tappeiner 1998, Miller and Emmingham 2001).

Treating mature stands in the Green Mountain project is expected to increase availability of resources such as sunlight to the forest floor for increased diversity of shrubs, herbs, and understory tree establishment and growth with the effects lasting up to about 15-20 years as the overstory crown closes in (Chan, 2006). In addition to the understory response, increased growth in the overstory is expected to last up to about 25 year (Latham and Tappeiner, 2002). Williamson (1982) found that 19 years after heavy thinning, a 100 year old thinned stand, had a 30 percent higher response to volume growth than did the control units. Thinning across all crown classes in a stand provides the longest term benefits to both large and small trees because of the time it takes to fill in the overstory canopy (Williamson and Price 1966).

Heavier thinning would likely promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. The large older trees in a stand often showed signs of rapid growth in lower densities when they were young (30-100 years), producing large stems and crowns. Evidence (Franklin et al 1981, Tappeiner et al. 1997) suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition. Old-growth stands typically have multiple canopy layers, and thinning promotes a second cohort, or canopy layer, by allowing for natural regeneration to occur (Tappeiner et al. 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established tolerant conifers (Winter et al 2002a, 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

A short-term (less than one year) impact to understory vegetation and below ground fungi could occur from logging. These short-term adverse effects would be expected to recover within two years post-harvest as regrowth of herbs and shrubs occur. The removal of host trees and soil disturbance from the yarding operation impacts below ground fungi (Courtney et al 2004). This adverse effect is reduced by minimizing additional soil impacts with the use of designated skid trails with ground–based yarding systems and log-suspension capabilities of skyline and helicopter yarding systems.

Gaps (GS): Gaps would be randomly placed unless it was necessary to strategically place the openings within a stand for other resource benefits such as minimizing conflict for current and/or expected future logging operations. Gaps may also be placed to provide higher quality early seral habitat for wildlife species like big game, or to provide scenic vistas. The gaps would be randomly shaped following features of the landscape when available, and would range in size from approximately 1-3 acres. When a root rot pocket is identified, a gap would be placed with a 50-foot buffer established around the outside of the root rot pocket which could result in a gap larger than three acres.

Gaps would be placed in stands to provide for horizontal and vertical diversity, or in stands that have been identified as potentially higher quality early seral habitat areas by our district wildlife biologist. A thinning prescription would be applied to the area outside the gaps.

Gaps would not be a conventional clear-cut treatment. Although not always, to provide diversity, 1-4 green trees in either scattered pockets and/or scattered would be retained throughout the opening post-harvest. These retention trees would be released to grow to encourage large tree development, future snag development, diversity in future stand structure, and development of future large down woody debris. In 30 to 60 years the stand structure would be more complex with at least a two cohort stand making up the overstory. This would better mimic some late successional characteristics than what the current stand is projected to produce in the same time frame if no treatment occurred (Andrews et al. 2005).

Dominant Tree Release (DTR): DTR is a method that replicates small disturbances and increases structural variability. This prescription would provide for growth of a dominant tree or group of five to ten trees to promote larger trees scattered throughout the stands. The area around the dominant tree would be cut to a radius of 66 feet from the bole of an individual tree, or each tree in a group. Around an individual tree, the 66 feet equates to approximately ¼ acre (accounting for drip-line of trees) when one tree is identified. When five to ten trees in a clump are identified, the opening size would vary depending on the number and spacing of trees retained but would likely range from an estimated 1/3 to ½ acre. Sugar pine, and white pine would not be cut in the DTR. DTR trees would be randomly placed throughout stands, including riparian areas when the objective within the riparian area includes treatment.

Trees selected for DTR would be the largest trees that best represent site potential in a given area. When under represented species are identified in a stand, the DTR may target these species such as sugar pine, white pine, and western red cedar as the dominate tree to be released. Although the underrepresented species may not be a dominant tree, they would represent the dominant trees of their particular species and help increase diversity. Occasionally a group of two trees would be selected in one DTR. The canopy cover of the stand would be adjusted based on the ¼ acre DTR having a canopy cover of 4 percent.

Within all units, a sugar pine would be used as the dominant tree in an effort to help promote sugar pine's health and vigor as well as regeneration. Sugar pine that are 24" dbh and larger with a maximum of 5 trees selected per 10 acres would be used as Dominant Tree Release. All trees within a radius of one chain from the bole of the sugar pine would be cut and removed regardless of species with the exception of another sugar pine located within the cut area or a tree greater than the DBH of the sugar pine selected.

No Harvest Skips (NH): No harvest skips are areas within units that would not have trees removed however some trees within a skip may have trees cut and left on site such as in skyline corridors. There may also be wildlife trees or down wood created within these areas. These areas are include no harvest buffer around Riparian Reserves, sensitive botanical species, or are areas that are randomly selected to allow for natural succession to take place.

Regeneration Harvest - Shelterwood with Reserves

Regeneration harvest is the cutting or removing of trees to provide growing space for a new stand of trees. In the Green Mountain Project, these new trees will provide a sustainable supply of trees for the future. Shelterwood with Reserves is a method of regeneration harvest where you remove most of the trees, however you retain (reserve) some trees to provide a more suitable microclimate for the regenerating new trees. The intent of reserved trees is that they will not be cut in the future but will be used for other benefits such as to provide diversity for wildlife, aesthetics, or to provide future large natural snags and down wood.

Silviculturally these stands are currently at the culmination of mean annual increment. All stands are currently experiencing inter-tree competition, which creates stand stress and makes them susceptible to insect and disease outbreaks. On average there would be 20 trees retained per acre to help establish a future stand by providing a beneficial microclimate, and contribute towards creating snags and down wood. The regeneration harvest would result in more complex stand structure in 30 to 50 years with a two aged canopy layer that more closely mirrors what may have happened with natural disturbances on the landscape.

The residual canopy would be composed of the largest trees in the stand, primarily Douglas-fir. As identified in the Standards and Guidelines of the Northwest Forest Plan, at least 15 percent of each stand (not including Riparian Reserves) would be retained in no-harvest patches to provide diversity and maintain existing snags (Northwest Forest Plan, pg. c-41). The retained patches would be scattered and variable in size. Large wood on the forest floor would be maintained or enhanced. Numerous snags would either be maintained on site if not a hazard to logging operations, or enhanced through snag creation techniques. Retention areas would be set aside with no commercial products removed from the area. Snag and down woody debris creation would likely occur in the retention area and count towards the average snags and down woody debris within unit (Northwest Forest Plan, p. C-41).

Stands treated as regeneration harvest would be treated for fuels reduction and planted with a variety of tree species after harvest.

Post-Harvest Tree Planting

Reforestation would be expected to occur within five years of harvest, and occur from both tree planting and natural regeneration. Post-harvest densities would be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity with the ingrowth of species such as western white pine and western red cedar. Skid roads in planting areas are expected to be subsoiled to a depth of 18-22 inches to reduce the effects of compaction with the exception of soils under a retention tree canopy because the roots of the given tree would be less disturbed. Compaction from skid roads has not shown a reduction in residual tree growth (Miller et al, 2007). Slash and other debris would be utilized as shade and as a deterrent to browse by ungulates. Planting in identified root rot pockets would be species that are less susceptible to root rot like western red cedar, sugar pine, white pine or red alder. No additional effects would be realized by completion of this project because planting has been accounted for in the Forest and Stand Structure analysis.

Natural regeneration is unpredictable based on timing of cone crops and occupation of the site by competing vegetation, therefore surveys would occur around three years after treatment to verify minimum stocking levels in the natural regeneration. If surveys show less than 200 trees per acre are present, planting with western red cedar, white pine, sugar pine, and/or Douglas-fir would occur to augment the natural regeneration.

Fuels Treatments Description

Post-harvest fuels treatments are intended to reduce fuels following harvest. Treatments are guided by the Forest Plan standards and guidelines for Maximum Acceptable Fuel Loadings of downed woody material. These guidelines are as follows (FW-212 and FW-252):

Within the proposed harvest units it is estimated (from field surveys and photo series) that current surface fuel loading on average is below the Forest Plan standards and guidelines. However, in many stands post-harvest fuel loadings are projected to be above standards and guidelines.

Guidelines for Downed Woody Material	
Diameter	**Tons/Acre**
0-3”	7-11
3”-9”	8-12
9”-16”	18-20
>16”	8-15 pieces/acre >20ft.

Proposed post-harvest fuels treatments would consist of yarding tops, hand piling, mechanical treatments and/or underburning. The implementation of fuels treatment may vary in method from what is the proposed in the alternatives to meet standards and guidelines (i.e. grapple piling instead of underburning). However, the implemented fuels treatments would remain within the range of effects analyzed in the Environmental Impact Statement.

Hand Treatment and Mechanical Treatments: Hand treatment require manually hand piling created slash that is ≥1 inch in diameter and ≥3 feet in length. Mechanical treatments use machines to pile or chip/mulch fuels. Slash piles may occur within the unit or at landing(s). Piles would generally be placed in locations to minimize the damage of residual standing snags or live trees; however some piles could be located to cause tree mortality to create snags for wildlife habitat. Hand, grapple, and landing piles are covered with approved plastic following construction and burned at a later date after the slash has sufficiently dried (1-2 years post-harvest). This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall or early winter when there is very low risk of the piles spreading into other fuels surrounding the piles.

Yarding Tops: Yarding tops occurs during harvest operations. Tree tops are removed from the harvest unit to the landing areas. The tops are then separated where they can either be utilized (i.e. firewood or biomass) or piled for burning within a few years post-harvest. This treatment aids in reducing the post-harvest fuel loading within the harvest unit.

Post-Harvest Underburn: Post-harvest underburns are intended to reduce fuels created by harvest activities and help promote structural and biological diversity in stands. Underburning would comply with Forest Plan standards and guidelines in regards to consumption of fuels and maintaining down-woody material, duff cover, and snags. Underburns would be conducted during optimal weather and fuels conditions, most likely in the spring or fall. The weather and fuels conditions would be specific to the unit's location and fuel loading and tempered speeds of ignition to reduce mortality of residual canopy. An objective for the post-harvest underburning would be to minimize overstory tree mortality; however, some mortality of 0 to 10 percent would be acceptable and would also aid in wildlife snag enhancement. Mortality trees that occur adjacent to roads may be removed for safety reasons.

Underburns may require the construction of handlines around the unit perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Handlines are created by scraping fuel back to an approximate 18" mineral soil line and scattering fuels that lie within about 10 feet of the proposed line. If units are located on a steep slope waterbars are created within the fireline to reduce erosion potential.

Roads Treatments

Road Maintenance: For all action alternatives, existing forest roads needed for harvest activity would be maintained to allow safe access to harvest areas and to reduce adverse impacts to resources. Road maintenance associated with haul routes would result in decreased maintenance cost, improved safety, and reduced potential for resource damage related to degraded roads that would be needed for current and future resource management. Road maintenance activities may include felling danger trees, clearing and grubbing, replacing drainage structures, asphalt pavement patching, repairing holes in the roadbed, reconstructing ditches, application of dust abatement material, and placement of aggregate surfacing.

Temporary Road Construction and Decommissioning: Temporary roads would be created in both action alternatives. These roads would be placed in areas to minimize impacts to resources and would be decommissioned after use. Previously disturbed sites would be utilized where possible. The initial effects of the construction would be compacted soils; however those effects would be offset by decommissioning. The effects of decommissioning would be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction and root growth, so increased growth is possible along skid trails and landings that have treatment.

System Road Storage and Decommissioning: Roads would be closed with a physical barrier and non-drivable water bars installed as needed. Culverts would be removed from stream channels with fills of shallow to moderate depth. Fill depth would be reduced for culverts in deep fill locations, and side cast material would be pulled back. Roads identified for decommissioning may include any of the following treatments described with road storage but may also include removal of culverts from stream channels in deep fills, slope recontouring, and sub-soiling. These roads are no longer needed and will be removed from the transportation system.

Seasonal Road Closure Removed: Seasonal road closures on Forest Service roads 1900-430 and 1900-431.

Seasonal Road Closure Changed to Permanent Road Closure: Seasonal road closure along Forest Service road 1900-240 will be modified to a year-round closure on the uppermost three miles. The existing seasonal gate located at M.P. 0.00 will be removed and a new gate will be installed at M.P 6.30.

Bridge Replacement: Replace the Hardy Creek Bridge on Forest Service road 1980-204 as the existing bridge is failing.

Rock Obtained from Expanding Existing Quarries: The development of rock quarries is needed for maintaining roads accessing the Green Mountain project area. It is estimated that less than 15,000 cubic yards of crushed rock, rip rap and borrow material would be needed. Blasting would be required during rock quarry development, resulting in noise impacts on wildlife to be considered in the analysis. Rock quarry development could occur within five years of the project decision at the following six quarries: Lowell Pass (aka HiYu pit), Upper Green Mountain, Boro, Hidden Lake, Blue Starr and Indian Ridge.

Appendix C – Detailed List of Project Activities by Unit for the Preferred Alternative

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning	Gap Acres	DTR Acres	Shelterwood w/ Reserves	Skips	Skips in Riparian Reserve	Net MBF for Unit	Net MBF per Harvest Acre
40	25	108	1	17	0	5	2	0	1	1	753	31
41	10	125	0	8	0	2	0	0	0	0	384	38
60	21	30	11	7	9	0	3	0	11	2	222	12
70	55	46	4	34	3	12	5	0	4	1	1,237	23
80	24	36	0	13	0	6	3	0	0	0	373	17
130	61	45	17	0	13	0	0	34	17	4	1,481	32
140	15	33	0	12	0	0	2	0	0	0	299	21
150	38	26	3	29	2	0	6	0	3	1	445	12
160	16	40	0	14	0	0	2	0	0	0	358	22
200	37	35	0	21	0	9	5	0	0	0	629	18
220	16	30	11	2	0	0	1	0	11	11	38	13
230	26	40	11	9	2	2	4	0	11	9	289	17
240	18	36	8	5	0	3	1	0	8	8	174	19
250	14	34	3	8	2	0	3	0	3	1	205	16
260	10	34	5	3	0	0	2	0	5	5	126	25
290	38	37	15	0	0	0	0	17	15	15	476	28
300	66	33	15	33	1	9	6	0	15	14	980	20
310	22	42	5	10	0	0	6	0	5	5	462	29
320	36	48	0	18	0	6	4	0	0	0	901	32
330	25	37	9	10	0	3	3	0	9	9	391	24
350	14	38	6	5	1	0	3	0	6	5	150	17
380	40	32	7	22	6	3	6	0	7	1	632	17
390	57	43	12	30	9	9	4	0	12	3	1,159	22
400	22	29	5	13	3	3	1	0	5	2	230	11
410	34	33	14	11	9	6	2	0	14	5	420	15
420	53	45	16	23	3	9	3	0	16	13	1,070	28
430	29	33	11	13	6	0	5	0	11	5	624	26
440	25	32	3	12	2	6	3	0	3	1	633	28
500	17	28	10	2	6	0	2	0	10	4	173	17
530	12	30	8	2	5	2	0	0	8	3	121	13
580	45	34	31	8	20	3	1	0	31	11	824	26
600	92	36	29	35	21	21	4	0	29	8	2,123	26
610	39	35	3	0	2	0	0	30	3	1	857	27
630	14	38	0	0	0	0	0	12	0	0	309	26

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning	Gap Acres	DTR Acres	Shelterwood w/ Reserves	Skips	Skips in Riparian Reserve	Net MBF for Unit	Net MBF per Harvest Acre
640	45	36	6	24	4	9	4	0	6	2	610	15
650	19	34	9	0	5	0	0	7	9	4	269	22
680	33	31	8	19	6	3	3	0	8	2	538	17
690	81	41	42	19	30	18	0	0	42	12	1,187	18
720	24	38	12	0	7	0	0	8	12	5	314	21
740	43	43	10	0	0	0	0	27	10	10	435	16
750	28	31	1	17	0	6	3	0	1	1	447	17
760	29	34	10	12	5	3	3	0	10	5	311	14
770	43	32	22	12	17	6	2	0	22	5	549	15
780	35	49	10	20	4	0	4	0	10	6	528	19
790	45	33	20	15	11	6	3	0	20	9	484	14
800	19	46	7	7	5	0	4	0	7	2	305	19
820	32	44	15	10	2	3	3	0	15	13	672	37
830	33	30	10	0	6	0	0	18	10	4	604	25
840	36	31	29	4	9	0	3	0	29	20	300	19
850	35	35	12	0	9	0	0	18	12	3	896	33
860	53	48	19	20	13	9	3	0	19	6	838	19
890	19	63	3	11	2	4	1	0	3	1	490	27
980	48	36	12	22	10	10	3	0	12	2	747	17
990	41	45	15	15	10	6	3	0	15	5	563	17
1020	49	45	22	19	18	3	3	0	22	4	549	13
1030	33	29	3	0	2	0	0	25	3	1	480	18
1040	22	45	0	0	0	0	0	19	0	0	412	22
1060	79	35	13	41	9	15	5	0	13	4	1,289	18
1070	34	46	8	0	3	0	0	21	8	5	769	32
1090	17	31	7	8	2	0	2	0	7	5	130	11
1100	43	49	20	14	10	6	2	0	20	10	681	21
1110	14	33	6	6	5	0	2	0	6	1	279	21
1120	34	29	9	18	7	0	5	0	9	2	554	18
1130	35	46	12	0	8	0	0	17	12	4	464	19
1160	29	35	23	2	3	4	0	0	23	20	198	22
1190	7	51	6	1	5	0	0	0	6	1	162	27
1200	30	31	19	7	13	0	4	0	19	6	302	13
1240	39	32	8	22	5	3	3	0	8	3	429	13
1290	51	44	25	15	16	3	3	0	25	9	912	25
1310	34	36	18	7	14	0	5	0	18	4	396	15
1320	54	47	27	12	16	5	2	0	27	11	389	11

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning	Gap Acres	DTR Acres	Shelterwood w/ Reserves	Skips	Skips in Riparian Reserve	Net MBF for Unit	Net MBF per Harvest Acre
1330	32	32	22	4	11	3	2	0	22	11	240	12
1340	8	39	5	2	2	0	0	0	5	3	78	19
1350	8	40	7	0	5	0	0	0	7	2	176	35
1360	10	39	1	7	1	0	2	0	1	0	222	22
1370	33	33	17	7	6	3	3	0	17	11	208	11
1380	19	47	10	5	9	0	2	0	10	1	342	21
1410	57	72	16	33	15	0	4	0	16	1	815	16
1430	27	33	15	9	13	0	2	0	15	2	325	14
1450	23	34	0	17	0	0	3	0	0	0	342	17
1490	29	34	18	4	6	3	2	0	18	12	243	16
1500	27	31	15	5	0	3	3	0	15	15	258	23
1540	58	43	13	32	6	6	2	0	13	7	579	13
1570	43	34	39	4	25	0	0	0	39	14	616	21
1610	18	27	14	2	8	0	1	0	14	6	122	11
1830	9	144	0	7	0	0	0	0	0	0	319	46
1840	14	144	0	10	0	0	1	0	0	0	523	48
1850	38	33	19	14	13	3	0	0	19	6	471	16
1880	2	144	0	2	0	0	0	0	0	0	79	40
1890	31	129	7	21	0	0	3	0	7	7	704	29
1910	17	40	4	9	0	0	3	0	4	4	326	27
1920	39	35	21	9	12	3	3	0	21	9	595	22
1930	36	36	27	5	12	0	3	0	27	15	230	11
1940	40	37	25	7	5	0	4	0	25	20	203	13
1950	44	35	23	12	17	3	3	0	23	6	615	18
1960	33	36	16	12	12	0	2	0	16	4	446	17
1980	46	41	17	17	5	6	3	0	17	12	653	21
5030	77	40	52	13	31	6	4	0	52	21	857	16
5040	36	38	5	26	4	0	3	0	5	1	914	28
5050	12	27	12	0	6	0	0	0	12	6	86	14
5080	25	38	22	2	15	0	1	0	22	7	487	27
5090	40	30	37	2	4	0	1	0	37	33	91	13
5120	18	36	5	9	4	0	2	0	5	1	230	15
5130	14	34	4	6	3	0	2	0	4	1	160	15
5140	30	36	4	22	3	0	2	0	4	1	386	14
5160	35	35	25	5	20	0	2	0	25	5	326	12
5170	34	34	12	13	2	0	6	0	12	10	332	16
5180	31	33	18	7	6	0	1	0	18	12	133	10

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning	Gap Acres	DTR Acres	Shelterwood w/ Reserves	Skips	Skips in Riparian Reserve	Net MBF for Unit	Net MBF per Harvest Acre
5230	58	36	51	4	31	0	1	0	51	20	497	14
5260	38	31	23	8	14	0	4	0	23	9	453	17
5320	35	33	21	8	16	3	3	0	21	5	333	11
5360	53	31	32	10	16	3	5	0	32	16	716	21
5370	10	38	6	4	5	0	0	0	6	1	120	13
5380	7	35	7	0	6	0	0	0	7	1	90	15
5390	52	34	28	14	20	3	3	0	28	8	448	11
5400	31	31	18	9	15	0	2	0	18	3	247	9
5410	23	34	13	7	10	0	2	0	13	3	267	14
5420	45	41	37	2	26	4	2	0	37	11	659	19
5430	20	27	12	4	0	0	3	0	12	12	138	20
5440	78	37	29	34	11	6	6	0	29	18	989	17
5450	34	33	16	11	4	0	5	0	16	12	480	24
5460	36	36	23	7	12	3	1	0	23	11	400	17
5470	24	37	15	5	10	0	3	0	15	5	339	19
5480	11	135	0	0	0	0	0	9	0	0	129	14
5510	14	93	0	7	0	0	2	0	0	0	284	32
5530	64	112	0	32	0	10	0	0	0	0	1,651	39
5710	17	117	0	17	0	0	0	0	0	0	213	13
5720	40	96	0	18	0	2	0	0	0	0	410	20
5730	41	97	0	17	0	0	0	0	0	0	293	17
5740	30	90	0	15	0	0	0	0	0	0	260	17
5770	41	110	0	0	0	0	0	34	0	0	939	28
5780	35	106	0	0	0	0	0	29	0	0	846	29
5800	44	139	12	25	8	3	4	0	12	4	2,005	50
5810	13	122	1	7	0	3	0	0	1	1	499	50
	4,398		**1,662**	**1,454**	**901**	**320**	**291**	**325**	**1,662**	**761**	**66,468**	**20**

Appendix D - Road Treatment Proposals

Road Number	Length	Haul Route	Current Status	Proposed Treatment Alternative 2 and 3	Comment
1900425	1.03	Yes	Open	Storage	
1900425	0.61	No	Open	Storage	
1900427	0.71	Yes	Open	Storage	
1900428	0.12	Yes	Open	Storage	
1900428	0.48	No	Open	Storage	Road currently closed by gate
1900429	0.70	No	Open	Storage	Road currently closed by gate
1900432	0.50	Yes	Open	Storage	
1900432	1.61	No	Open	Storage	
1900432	0.32	No	Open	Storage	
1900443	0.16	No	Open	Storage	
1900444	0.14	No	Open	Storage	
1900446	1.21	No	Open	Storage	Road currently closed by gate
1900455	0.10	Yes	Open	Storage	
1900458	0.20	No	Open	Storage	Road currently closed by gate
1900459	0.56	No	Open	Storage	Road currently closed by gate
1900745	0.07	Yes	Open	Storage	
1900745	0.30	No	Open	Storage	
1900766	0.10	Yes	Open	Storage	
1900771	0.10	Yes	Open	Storage	
1900772	0.12	Yes	Open	Storage	
1900773	0.25	Yes	Open	Storage	
1900774	0.40	No	Open	Storage	
1900902	0.12	Yes	Open	Storage	
1900902	0.08	No	Open	Storage	
1900903	0.35	Yes	Open	Storage	
1900919	0.22	No	Open	Storage	
1900985	0.50	No	Open	Storage	
1900987	0.34	No	Open	Storage	

Road Number	Length	Haul Route	Current Status	Proposed Treatment Alternative 2 and 3	Comment
1927101	0.11	Yes	Open	Storage	
1927102	0.17	Yes	Open	Storage	
1927102	0.04	No	Open	Storage	
1927141	0.26	Yes	Open	Storage	
1927141	0.13	No	Open	Storage	Road currently closed by gate
1927142	0.44	Yes	Open	Storage	
1927150	0.94	No	Closed	Storage	
1927151	0.04	No	Closed	Storage	
1927155	0.44	No	Closed	Storage	
1927157	0.19	No	Closed	Storage	
1927170	0.08	No	Open	Storage	
1927199	0.20	Yes	Closed	Decommission	
1927212	0.10	No	Open	Storage	
1927230	0.06	Yes	Open	Storage	
1927240	3.00	No	Open	N/A	Relocate seasonal closure to permanent closure M.P. 6.30
1927283	0.19	No	Open	Storage	
1927284	0.22	No	Open	Storage	
1927287	0.07	No	Open	Storage	
1927288	0.14	No	Open	Storage	
1927290	0.09	No	Open	Storage	
1927299	0.09	No	Open	Storage	
1958301	1.35	Yes	Open	Storage	
1958304	0.60	Yes	Open	Storage	
1958315	0.58	No	Open	Storage	
1958346	0.27	No	Open	Storage	
1958350	0.20	Yes	Open	Storage	
1958475	0.07	No	Open	Storage	
1964414	0.17	No	Open	Storage	
1980226	0.21	Yes	Open	Decommission	
1980232	0.02	Yes	Open	Storage	

Road Number	Length	Haul Route	Current Status	Proposed Treatment Alternative 2 and 3	Comment
1980250	0.10	No	Open	Storage	
1980282	0.05	No	Open	Storage	
1980299	0.03	Yes	Open	Storage	
1980303	0.04	Yes	Open	Storage	
1980316	0.38	Yes	Open	Storage	
1980323	0.02	Yes	Open	Storage	
1980324	0.03	Yes	Open	Storage	
1980344	0.11	No	Closed	Decommission	
1980346	0.10	No	Open	Storage	
1980348	0.18	Yes	Closed	Decommission	
1980372	0.30	Yes	Closed	Decommission	
1980372	0.07	No	Closed	Decommission	
1980374	0.12	No	Closed	Decommission	
1980423	0.65	No	Open	Storage	
1980480	0.09	Yes	Open	Storage	
1985125	0.07	No	Open	Storage	
1985127	0.09	No	Open	Storage	
1985272	0.06	Yes	Open	Storage	
1985290	0.55	Yes	Closed	Decommission	
1985293	0.08	Yes	Closed	Decommission	
1985295	0.13	Yes	Closed	Decommission	
1986121	0.14	No	Open	Storage	
1986126	0.38	Yes	Open	Storage	
2618380	0.40	No	Open	Storage	

Appendix E - Evaluation for Consistency with the Aquatic Conservation Strategy

Introduction

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A goal of this strategy is to maintain a "natural" disturbance regime. In addition, management activities must comply with nine objectives that are included in the strategy and any associated standards and guidelines. A variety of tactics to accomplish these goals and objectives are incorporated into four primary components. These components are:

Riparian Reserves
Key Watersheds
Watershed Analysis
Watershed Restoration

These four components, along with Late Successional Reserves, are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl - USFS, BLM 1994, (ROD), pages B9-B12).

Riparian Reserves

The Northwest Forest Plan defined Riparian Reserves as "portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply" (ROD page B12). Riparian Reserves include those portions of a watershed directly coupled to streams, ponds, lakes, and wetlands - that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water (ROD pgs. B-12 and B-13).

The Riparian Reserve network in the South Fork McKenzie watershed totals over 65,570 acres which is over 47% of the entire land base (South Fork McKenzie Watershed Analysis 2010). The Watershed Analysis made no final recommendations to adjust Riparian Reserve widths for the streams in the watershed, retaining the initial reserve widths (based on site potential tree height) from the ROD for all streams.

During the analysis for the Green Mountain Project, no reductions of Riparian Reserve widths along any streams were proposed. However, silvicultural treatments were proposed within Riparian Reserves for some units in order to improve structural and species diversity. Timber harvest is generally prohibited within Riparian Reserves, but there are 3 exceptions provided in the ROD. One of which is Standard and Guideline TM-1(c).

<u>Standards and Guidelines (S&Gs)</u>

TM-1(c). Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Standard and Guideline TM-1(c) in the Northwest Forest Plan (1994) provides direction on when silvicultural activities can take place in Riparian Reserves. The McKenzie River Ranger District's task is to review all the Riparian Reserves in the project area and at the landscape level to determine if treatment is warranted. Based on field investigations and a landscape level analysis of hardwoods in the South Fork McKenzie watershed, recommendations were developed for each Riparian Reserve. Treatments within Riparian Reserves are proposed where are dense, overstocked, and conifer dominant stands with very little structural and species diversity and understory development. This lack of complexity and diversity is outside the natural range of variability and may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian-dependent wildlife. In other portions of Riparian Reserves, however, there is higher structural and species diversity and riparian stands are providing adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian dependent wildlife. Treatments were not recommended in these areas.

Key Watersheds

The Northwest Forest Plan created an overlay of Key Watersheds that are intended to provide refugia for at-risk stocks of anadromous salmonids and resident fish species. Refugia are a cornerstone of the conservation strategy for these species, consisting of watersheds that provide high quality habitat or are expected to provide habitat. Two different levels of protection, or tiers, are identified, as well as non-Key watersheds (ROD page B19). In key watersheds, completion of a watershed analysis is required prior to most management activities. The South Fork McKenzie River is designated as a Key Watershed. One of the important components of Key Watershed is that there must be no net gain in roads. If new roads need to be built, then an equivalent mileage must be decommissioned.

<u>Standards and Guidelines</u>

No new permanent roads would be built in roadless areas in Key Watersheds.

The Green Mountain project is consistent with this S&G. No new permanent roads are proposed to be constructed in roadless areas. Temporary roads would be decommissioned upon completion of harvest activities.

Timber harvest cannot occur in Key Watersheds prior to completing a watershed analysis.

A watershed analysis was completed for the South Fork McKenzie watershed in 1994 and was updated in 2010.

Watershed Analysis and Watershed Restoration

South Fork McKenzie Watershed Analysis (WA) was prepared for the McKenzie River Ranger District in 1994 and updated in 2010. The watershed was characterized in terms of past and current conditions, and a synthesis discussion was provided to guide development of management proposals to maintain and restore watershed conditions.

The Green Mountain Project has incorporated information from the WA into the project design. Current vegetative landscape patterns reflect past management activities that did not consider what the landscape might look like under natural disturbance regimes. Many of the proposed activities seek to create vegetative patterns, late successional stand structures, and fuel loadings that would have been typical of this landscape under the natural disturbance regimes that historically occurred in the area.

Watershed restoration has been ongoing in the South Fork McKenzie River since 1994. For example, large wood placement project have been implemented since 1996 and 841 trees have been added to the channel upstream of Cougar Reservoir. Numerous dispersed campsites adjacent to the South Fork have been closed and rehabilitated as well as one developed campground (Homestead). Roads have been decommissioned and stored in the watershed and more roads are proposed for these treatments in the Green Mountain project.

Aquatic Conservation Strategy Objectives

The previous discussions highlighted the consistency of the Green Mountain Project with the four components of the Aquatic Conservation Strategy. The management objective for Riparian Reserves in the project area is to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy (ACS) Objectives as directed in the Northwest Forest Plan. This section will outline how the activities proposed in the alternatives conform to the nine objectives. The information presented is summarized from Chapters 2 and 3 of the Environmental Impact Statement, where greater detail can be found.

In some cases, maintaining and/or restoring each one of the ACS Objectives can be a balancing act with trade-offs. For example, to meet the riparian vegetation objectives ("species composition and structural diversity of plant communities" and "habitat to support well distributed populations of native plant, invertebrate and vertebrate riparian dependent species") in young, dense conifer stands, a common silvicultural tool is to remove overstory density to encourage understory growth and structural development. Removal of overstory density, however, could potentially lead to increased thermal loading or reduction of wood volume available for recruitment if not designed correctly for the specific site. Because of these trade-offs, the McKenzie River Ranger District's interdisciplinary team carefully balance conflicting objectives based on characteristics of each waterbody and adjacent riparian area. Based on data gathered through landscape and stream reach assessments current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics needed to attain ACS Objectives. Therefore, there is a need to manage certain parts of Riparian Reserves. Other areas, however, are currently meeting desired vegetation characteristics and management is not necessary.

Objective #1 - Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Alternative 1 (No Action) – This alternative would maintain landscape complexity at the current condition. Several hundred acres of Riparian Reserves would remain in dense, overstocked, conifer-dominated stands with very little structural and species diversity and understory development until natural processes create openings and down wood.

This could take several decades or up to a century. Aquatic habitats would continue to experience a low volume of large in-stream wood. Until a fire or large flood disturbs the riparian habitat the South Fork will continue to have a low percentage of hardwood vegetation in the Riparian Reserves.

Alternative 2 – Proposed treatments would occur on 902 acres and are designed to accelerate the development of: (1) early-seral forest, which has been declining in the watershed as a result of fire suppression and historic land management, (2) older forest structure (e.g. large trees, large dead trees, spatial structure and compositional heterogeneity, etc.), which was dramatically reduced in the last century by historic land management, and (3) a greater abundance of deciduous and herbaceous species, which have subsequently declined with the loss of early- and late-seral forest. Though no regeneration harvest is proposed within Riparian Reserves, upland regeneration treatments would enhance early-seral habitat within the watershed and the overall diversity and complexity across the landscape. Treatments to accelerate late forest structure are proposed within some portions of Riparian Reserves. These thinning treatments were designed to emulate, to the extent possible, conditions under a natural fire regime. Primary shade and wood recruitment zones would be protected on every waterbody and existing high quality habitat within Riparian Reserves would be maintained within no-treatment buffers. The objective is to provide a balance between the maintenance of existing habitat for species, populations, and communities, with opportunities to develop landscape scale features with distribution, diversity and complexity of the historical landscapes. This includes aquatic and riparian elements of the landscape.

Additionally, over 64,300 acres of Riparian Reserves throughout the South Fork 5th field would remain untreated.

Alternative 3 – The effects of Alternative 3 would be similar to Alternative 2 with the exception that 894 acres would be treated – 8 acres less. Likewise, fewer acres would be treatments outside the Riparian Reserves, and there would be no early-seral creation.

Objective #2 - Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Alterative 1 (No Action) –Failing culverts and inadequately maintained roads would continue to affect the ability of some aquatic species to disperse. Otherwise, implementation of this alternative would maintain existing spatial and temporal connectivity.

Alterative 2 – Riparian Reserves, as established by the Record of Decision for the Northwest Forest Plan and re-assessed in the South Fork McKenzie Watershed Analysis have been incorporated into the design of all treatment units where streams occur. Active management is proposed within Riparian Reserves on approximately 902 acres, where it has the potential to enhance functions such as the development of future large wood, stand structural diversity, vegetative species richness and diversity, and other late successional characteristics. Road treatments include upgrade of stream crossings to accommodate 100-year flood events, so that these events can flow through the landscape unimpeded and without the risk of catastrophic fill failures. A bridge would be replaced over Hardy Creek and would maintain migratory routes for all native fish species, amphibian, and aquatic macroinvertebrates. A temporary bridge would be placed over Elk Creek and removed when no longer needed. This bridge will maintain migratory routes for all native fish species, amphibians, and aquatic macroinvertebrates. Stream-adjacent riparian corridors would be maintained through no-treatment buffers and outer portions of some Riparian Reserves would be treated to improve late forest structure for wildlife.

Alternative 3 – Implementation of this alterative incorporates many of the same elements as Alternative 2. Fewer culverts would be upgraded though most of these are on intermittent streams high up on the slopes where fewer aquatic species reside. Also 8 fewer acres of riparian thinning would occur.

Objective #3 - Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Alternative 1 (No Action) – Implementation of this alternative would maintain existing conditions. Roads and drainage features would continue to fail creating potential for damage to channel integrity. Large in-stream wood levels would remain low for several decades until natural processes occurred to create it.

Small wood levels would remain at normal to high levels as the stands develop. The ability of some streams to store gravels would be greatly reduced during this time which would continue to alter the channel morphology.

Alterative 2 – All proposed treatments were designed with channel stability in mind. All harvest activities restrict the use of ground disturbing equipment in and around streams, and provide for retention of all vegetation that is contributing to the stability of banks and channels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors would be retained on site as down woody material.

Trees cut for the near stream gaps would all be maintained on site for down woody material. Stumps and their rootwads would maintain bank stability for a number of years. The duration is typically considered 5 years but we have noted stumps along streams providing stability for a decade. In addition, hardwoods would begin to colonize the gaps and their root systems would provide for bank stability. It is expected that hardwoods would be fully established in the gaps in six to ten years.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Green Mountain Project addresses this concern by minimizing permanent road construction and upgrading numerous culverts. Approximately 130 miles of maintenance and reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms. Approximately 10.3 miles of temporary roads will be constructed on stable locations which is around 51.5 acres of ground disturbance. Of those, only 2.3 miles (11 acres) are within Riparian Reserves. All of these will be obliterated following harvest activities. Additionally, approximately 3.5 miles of road would be decommissioned and 21.1 miles stored in a hydrologically stable condition.

There are 14 proposed temporary road crossings which are needed to access portions of units. Typical rates of revegetation start occurring within two decades from natural regeneration if the stand is not scheduled for replanting.

Addition of in-stream large wood along 2.7 miles of stream (mostly fish-bearing) would occur. This would impact stream banks or beds by increasing a streams ability to store and sort gravels thus adding to the channel complexity.

Alterative 3 – Implementation of this alternative would have similar effects as Alternative 2 with the exception of fewer road miles maintained (only 115 miles). This may result in impacts to the streams along roads not repaired. Fewer miles of temporary roads (only 8.6 miles which is about 43 acres) are proposed, and only about 2.1 miles (about 11 acres) of those are within the Riparian Reserves.

Objective #4 – Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Alterative 1 (No Action) – Implementation of this alternative would maintain existing water quality conditions including current levels of shade for stream temperatures. As stands continue to develop towards more natural conditions, conditions would improve also. Full water quality recovery could take several years to several decades in streams hit heavily by historic logging (clear-cutting to the stream edge) and stream "cleaning" (removal of in-stream wood).

Alternative 2 – Approximately 138 acres of Riparian Reserves are proposed for active treatment. Implementation of this would do nothing to immediately improve water quality. However, a primary objective of any treatment within the Riparian Reserves is to maintain compliance with the Regional Total Maximum Daily Load (TMDL) Implementation Strategy so that stream temperatures are not detrimentally impacted. Over 64,300 acres of Riparian Reserves throughout the South Fork 5th field would remain untreated. Where vegetative treatments are proposed within Riparian Reserves, effective stream shading is retained at levels sufficient to maintain water temperature. A minimum of 50% canopy closure (approximately 40% canopy cover) is preserved throughout the Riparian Reserve to help protect the secondary shade zone and maintain the microclimate.

No-harvest buffers were developed to preserve the primary shade zone. Most of the class 3 and all of class 2 streams have a minimum 60-foot no-harvest buffer based off of slope, vegetation size, and stream width. For a list of Design Features that protect water quality, see Chapter 2.

Where in-stream wood or near-stream gaps are proposed, analysis indicates that thermal loading is naturally low. The lengths of stream exposed to direct solar radiation are kept to a minimum to achieve resource objectives while providing shaded reaches to cool the stream immediately below the treatments. Additionally, the creation of in-stream wood improves gravel storage and pool formation which in turn increases hyporehic exchange and improving cold water influx to the channels.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2. Design features for protecting stream-side shade and water quality is the same though there are 8 fewer acres proposed for thinning in Alternative 3. The acres Riparian Reserve gaps and the miles of in-stream wood creation are the same. As with Alternative 2, treatments have been designed to comply with the Northwest Forest Plan Temperature TMDL Implementation Strategy.

Objective #5 – Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Alterative 1 (No Action) – Approximately 50% of the South Fork McKenzie 5th field watershed lies in designated wilderness. This helps provide for landscape processes that are dominated by nature rather than humans. Implementation of this alternative would maintain existing anthropogenic sediment input at their current levels for potentially several years. However, Alternative 1 would not correct existing road erosion problems nor reduce the risk of future road or culvert failure.

Alternative 2 – Project design elements are intended to maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations, as discussed above under ACS Objective #3. These design elements will also provide protection to water quality from the introduction of sediment into streams and resulting effects on stream turbidity.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Green Mountain Project addresses this concern by minimizing permanent road construction and upgrading numerous culverts. Approximately 130 miles of maintenance and reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms. During culvert replacement, some sediment may enter the stream system. However, the amount will be minimized by following Best Management Practices (BMPs), and the impact to the aquatic ecosystem would be relatively short lived (1-2 seasons) and only a few yards downstream. Approximately 10.3 miles of temporary roads (about 51.5 acres) will be constructed on stable locations, and all of these will be obliterated following harvest activities. Of those, only 2.3 miles (11 acres) are within Riparian Reserves. Additionally, approximately 3.5 miles of road would be decommissioned, and 21.1 miles would be stored in a hydrologically stable state.

All proposed treatments were designed with sediment transport potential in mind. All harvest activities follow BMP guidelines and restrict the use of ground disturbing equipment in and around streams. This reduces the potential of water routing along skid roads or the creation of overland flow due to high compaction levels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors would be retained on site as down woody material.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2 with the exception of fewer road miles maintained or reconstructed. This may result in impacts to the streams along roads not repaired. Fewer miles of temporary roads (8.6 miles which is about 43 acres) are proposed, and only about 2.1 miles (about 11 acres) of those are within the Riparian Reserves.

Objective #6 – Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration and spatial distribution of peak, high, and low flows must be protected.

Alterative 1 (No Action) – Approximately 50% of the South Fork McKenzie 5th field watershed lies in designated wilderness. This helps provide for landscape processes that are dominated by nature rather than humans. Implementation of this alternative would maintain existing in-stream flows.

Alternative 2 – This alternative maintains current canopy cover at levels well above the maximum mid-point Aggregate Recovery Percentage (ARP). Therefore, no altered flows are anticipated from implementation of this alterative.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2, and no altered flows are anticipated.

Objective #7 – Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Alterative 1 (No Action) – As mentioned in previous objective, approximately 50% of the South Fork McKenzie 5th field watershed lies in designated wilderness which helps provide for natural landscape processes Implementation of this alternative would maintain existing floodplain inundations and water table elevations.

Alternative 2 – Implementation of a landscape design that is intended to restore vegetative structures within young dense stands, landscape patterns, and disturbance regimes to a more natural condition will result in watershed conditions that more closely resemble those under which historic stream flow conditions developed.

Floodplains and wetland areas were excluded from consideration for harvest activities and where treatment units occur adjacent to these features, ground based equipment that could impact the soil and result in altered groundwater movement are restricted.

Addition of in-stream wood has the potential to alter floodplains. However, research has shown that this type of alteration usually leads in increased channel complexity and improved aquatic habitat.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2.

Objective #8 - Maintain and restore the species compositions and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Alternative 1 (No Action) – This alternative would maintain landscape complexity at the current condition. Several hundred acres of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings in which hardwoods and understory species could thrive. This could take several decades. Aquatic habitats would continue to experience low volumes of in-stream and terrestrial down wood. However, small down wood levels would remain at normal to high levels as stands develop.

Current rates of wood recruitment, provided mostly by stem mortality (from competition, disease, wind and snow downed trees) and bank erosion, would be maintained. Alternative 1 would provide a slightly higher rate of in-stream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90 percent of the wood recruitment zones, the No-Action alternative would protect 100 percent. In some streams, recruitment trees are of sufficient size to meet ACS Objectives, but in other streams with small diameter riparian stands the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Small diameter trees are also more likely to be transported out of the system. In-stream wood abundance is low for most streams in the project area and is largely due to the lack of large enough wood to remain stable in channels.

The No-Action alternative would not accelerate desired vegetation conditions. Desired riparian conditions – high species and structural diversity with large dead and down wood – would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively lower levels. Accelerated restoration of riparian stands that currently do not meet ACS Objectives would not be accomplished. In addition, the currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands. A large disturbance event has the potential to reduce vegetation, large woody material, and stream shade across large areas of Riparian Reserves.

Alternative 2 –Approximately 902 acres of Riparian Reserves are proposed for treatment to reduce the density of overstocked riparian stands, increase species diversity and structural complexity, and accelerate tree growth. Selected streams were chosen for their vegetation characteristics at the stream catchment scale and at the stream reach scale. The impact of thinning on the long-term riparian forest structure and wood recruitment would be minor at the watershed scale, but would have positive impacts at the project scale. Aquatic habitats currently characterized as simplified may be expected to improve in substrate storage and habitat complexity over time thus improving their ability to meet aquatic life history needs at the site scale.

To develop stream-specific riparian treatments that attain the desired vegetative characteristics while providing for adequate down wood levels, large woody material (LWM) source areas were calculated at various distances from each stream channel in each unit. LWM recruitment zones and associated no-treatment buffers were defined based on effective tree heights, stream size, stream class, gradient, channel complexity, and how functional the existing coarse woody material was in the stream channel. Protecting at least 90 percent of potential wood inputs would maintain ACS Objectives related to in-stream wood while allowing for treatments to improve vegetation diversity and accelerate the growth of future in-stream wood.

The active management proposed in the treatment units would have the short term effect (years to a couple of decades) of reducing coarse woody material loading in the Riparian Reserve outside the no-harvest buffer. However, current levels of large down logs within most of the treatment stands are within historic levels. Field surveys of the Green Mountain proposed units during 2011 and 2012 showed approximately 38% of all proposed units to have higher levels of large down logs (over 14" diameter) over 6/acre, 58% had moderate levels of about 3-6/acre, and about 4% had low levels of large down logs under 3/acre. Many of the plantations showed relatively high levels of large down wood that was left from the original harvest, with quite large diameters over 40", such that it will last many more decades.

Where management is recommended in units with low down wood levels, dead and down wood objectives would be met through leaving more of the residual stand or through supplemental fall-and-leave treatments. The number of total trees per acre (i.e. this number includes trees less than 7 inches in diameter) range from 176 to 1,822. Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al 1997; Poage and Tappeiner 2002). Given the unnaturally over-stocked conditions of these managed stands, in the long term (decades to a century) there will still be adequate woody material to maintained volumes within the natural range of variability, and abundant overstory would be retained for future wood input sufficient to sustain physical complexity.

At present, most of the stands proposed for Riparian treatments are dense with a homogeneous overstory dominated by Douglas-fire. This forms a condition which shades out almost all light before it can reach the forest floor. Because of this, there are very little hardwoods or herbaceous vegetation on the forest floor. Thinning these stands outside of the streams primary shade zone will allow more sunlight to reach the forest floor and encourage greater vegetative diversity than currently exists.

In many cases where ACS vegetation objectives were already being met, no silvicultural treatments were proposed with Riparian Reserves. Over 64,300 acres of Riparian Reserves throughout the South Fork 5th field would remain untreated and provide landscape-scale diversity.

Wetlands and floodplain areas that are critical to nutrient filtering are eliminated from treatment areas and use of ground disturbing equipment adjacent to them is restricted. Near-stream gaps and large wood input will help improve the nutritional quality of organic matter delivered to streams and allow for increased primary productivity.

Use of low severity fire is restricted to the edges of Riparian Reserves where the risk of adverse effects on ground cover and duff retention cannot impact water quality and nutrient availability.

The majority of temporary roads would be located on ridge tops or gentle slopes or utilize previously disturbed locations not decommissioned with historic logging. Those segments located within the Riparian Reserves would be located well outside of the primary shade zone or cross perpendicular to the stream. Approximately 2.3 miles of temporary roads are proposed within the Riparian Reserves. This is approximately 11 acres of ground disturbance. There are five proposed temporary road crossings which are needed to access portions of units. Impacts to large wood are expected to be similar to those of thinning treatments. Typical rates of revegetation start occurring within two decades from natural regeneration if the stand is not scheduled for replanting.

In summary, any proposed management of Riparian Reserves in Alternative 2 would not deter attainment of ACS Objectives but would help to accelerate attainment.

<u>Alternative 3</u> - Implementation of this alternative would have similar effects as Alternative 2 with the exception there are fewer acres (8 acres less) proposed for thinning in Alternative 3. Fewer miles of temporary roads (8.6 miles which is about 43 acres) are proposed, but only about 2.1 miles (about 11 acres) of those are within the Riparian Reserves.

<u>Objective #9</u> – Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

<u>Alternative 1 (No Action)</u> – This alternative would maintain current habitat conditions for both aquatic and riparian-dependent species. Many of the aquatic and riparian-dependent species need complex stand structures like that found in old-growth stands in order to thrive while others need younger seral stages. However, several hundred acres of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings in which hardwoods and understory species could thrive. This could take several decades. Meanwhile aquatic and terrestrial habitats would continue to experience low volumes of down wood and a lack of deciduous leaf litter in over 902 acres.

<u>Alternative 2 –</u> Approximately 902 acres of Riparian Reserves are proposed for active treatment while over 64,300 acres of Riparian Reserves throughout the project area would remain untreated. This variation would help provide landscape-scale diversity.

This project complies with the Northwest Forest Plan and all of its applicable standards and guidelines. Option 9 was expected to maintain and restore late-successional and old-growth forest ecosystems, and provide adequate viability levels for all late successional species including species listed in the FSEIS ROD Table C-3. As discussed in the other Objectives above, some stands in Riparian Reserves are proposed for treatment to encourage development of large wood and late successional stand structure. This would help to create a rich variety of habitats for native species. Adequate amounts of down woody debris will be retained on site.

The South Fork McKenzie and its numerous tributaries provide excellent habitat for native fish. This is due to the cold, clean water. This habitat would be maintained by the implementation of no-harvest buffers along fish bearing streams and the addition of in-stream wood. Additionally, upgrades to several culverts will provide better dispersal opportunities to aquatic invertebrates and salamanders. Roads that are decommissioned will restore stream channels so that there will be unobstructed passage at the former road crossing.

<u>Alternative 3</u> - Implementation of this alternative would have similar effects as Alternative 2 with the exception that Alternative 3 proposes fewer acres (8 acres less) of Riparian Reserve thinning and fewer miles of road maintenance/repairs (115 instead of 130 miles).

Appendix F - Past, Present and Reasonably Foreseeable Future Activities Relevant to the Cumulative Effects Analysis

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

The table below provides a summary of past, present, and reasonably foreseeable future actions that overlap in time and space with the Green Mountain project and could contribute cumulative effects to the resources in the project area.

Action	Agency	Description	Resources Affected
Past Actions			
Cascade Thin	USFS	Timber harvest Completed 2013 Approximately 55 acres	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Hartz Reoffer Thin	USFS	Timber harvest Completed 2015 Approximately 115 acres	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Road 19 Salvage	USFS	Timber harvest Completed 2014 Approximately 120 trees	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants

Action	Agency	Description	Resources Affected
Past Actions			
Timber Harvest 1990-2015	USFS	Since 1990 only 6,048 acres of harvest have occurred on Forest Service lands in the project area, of which 1,690 acres were regeneration harvests and 3,361 acres of pre-commercial thinning. Only approximately 261 acres of harvest have occurred since 2000, none of which was regeneration harvest.	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Meadow Restoration and Maintenance	USFS	About 50 acres in five individual meadows in the Green Mountain project area have had encroaching conifers under 12” dbh cut, followed up by a prescribed burn as part of the Chucksney Grasshopper Ridge Meadow Restoration Project between 2006-2014. These burns have successfully killed larger trees within and along meadow edges, maintaining meadows and creating patches of snag and large down wood habitat. Murphy Meadow is a part of the larger Chucksney Grasshopper Meadow project area which had 48 acres of encroaching conifers cut in 2013 and 2014 in the Green Mountain project area. Both upper and lower Murphy Meadow had prescribed burns in the fall of 2015 which also met the project objectives by burning additional large tree patches outside the meadows.	Vegetation, Wildlife
The Upper South Fork McKenzie River Enhancement Project (EA)	USFS	Tree placement in 8.5 miles of South Fork McKenzie River in 2007 and 2008	Vegetation, Soil, Water, Wildlife, Fisheries
Reasonably Foreseeable Future Actions			
Streamside Complexity Project	USFS/OSU	Two 200m paired reaches will be established along 2 fish-bearing tributaries within the South Fork McKenzie River 5th field watershed (Augusta 6th field HUC). See internal scoping form for additional details.	Vegetation, Soil, Water, Wildlife, Fisheries
Rebel Road and Walker Road Decommissioning	USFS	Decommission approximately 5 miles road. See internal scoping form for additional details.	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Three Sisters Wildfire Risk Reduction Fuels Treatment	USFS	Reducing abundance of ladder fuels within road corridors and adjacent to the Three Sisters Wilderness. See internal scoping form for additional details.	Fire and Fuels, Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive

Appendix G – Recommended Riparian Reserve Treatments

The following table details all the streams surveyed and summary of the rational for the recommended riparian treatments.

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
60	3	8/18/2011	Diversity	60	30
60	4	8/18/2011	Diversity	60	30
60	4	8/18/2011	Diversity while groundwater protection	60	30
70	3	8/18/2011	Density. Issue to avoid further compaction	30	46
70	3	8/18/2011	Density. Issue is to avoid further compaction	30	46
130	3	8/18/2011	Diversity while protecting groundwater flow. Due to size of stream 90 feet instead of 60 feet.	90	45
130	3	8/18/2011	Diversity while protecting groundwater flow. Thin outside the no cut buffer to 40% canopy cover for vegetative diversity. There are no hardwoods along class 3 and minimal hardwoods along class 4.	90	45
130	4	8/18/2011	Diversity while protecting effective shade	30	45
150	4	8/18/2011	No streams in unit but class 4 outside of unit	30	26
220	3	8/18/2011	Adjacent stand older and probable source of LWD.	180	30
220	3	8/16/2011	Well on its way in meeting ACS objectives	180	30
230	3	8/16/2011	Well on its way in meeting ACS objectives	180	40
230	3	8/18/2011	Well on its way in meeting ACS objectives	180	40
230	4	8/18/2011	Well on its way in meeting ACS objectives	180	40
240	3	8/18/2011	Well on its way in meeting ACS objectives	180	36
250	4	8/18/2011	Diversity while protecting groundwater	30	34
260	3	8/18/2011	Adjacent stand older and probable source of LWD.	180	34
290	3	8/16/2011	Well on its way in meeting ACS objectives	180	37
290	3	8/16/2011	Well on its way in meeting ACS objectives	180	37
300	3	8/16/2011	Well on its way in meeting ACS objectives	180	33
310	3	8/16/2011	Well on its way in meeting ACS objectives	180	42
330	3	8/16/2011	Well on its way in meeting ACS objectives	180	37
350	3	8/16/2011	Well on its way in meeting ACS objectives	180	38
350	4	8/17/2011	Well on its way in meeting ACS objectives	180	38
380	3	8/18/2011	Diversity. Probably not naturally a class 3	60	32
380	4	8/18/2011	Structural and vegetative diversity	30	32
380	4	8/18/2011	Structural and vegetative diversity	30	32
390	3	8/18/2011	Northern Class 3 stream 180 foot no cut buffer and no burn buffer to protect Oregon Megomphix	180	43
390	3	8/18/2011	Diversity while protecting groundwater	60	43

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
390	4	8/18/2011	Diversity while protecting groundwater	60	43
390	4	8/18/2011	Diversity while protecting groundwater	30	43
400	3	8/18/2011	Diversity while protecting groundwater in earthflow	60	29
410	3	8/18/2011	Diversity while protecting groundwater in earthflow	60	33
410	3	8/18/2011	Stream is too marshy for gaps	60	33
420	3	8/18/2011	Douglas-fir monoculture but good large wood component. Gaps near stream to diversify vegetation and provide light for primary production in stream	180	45
420	4	8/18/2011	Diversity. Restoration of culvert blockage	30	45
430	3	8/18/2011	2, 0.25 acre fall-and-leave gaps to increase hardwood. Thinning Riparian Reserve to increase size.	60	33
430	3	8/18/2011	Stream flows through plantations. Protect near-stream wood while developing large component2, 0.25 acre fall-and-leave gaps to increase hardwood. Thinning RR to increase size	60	33
440	3	8/18/2011	Flows through plantations. Protect near-stream wood while developing large component.2, 0.25 acre fall-and-leave gaps to increase hardwood. Thinning RR to increase size	60	32
500	3	8/18/2011	Diversity w/ most of stream in plantations. Gaps for hardwoods and primary productivity	60	28
500	3	8/18/2011	Diversity w/ of most stream in plantations. Streamside gaps for hardwood and LWD	60	28
530	3	8/10/2011	Understory diversity and hardwood component for primary productivity. Gaps in this unit.	60	30
530	4	8/11/2011	Understory diversity and hardwood component for primary productivity. Gaps in this unit.	30	30
530	4	8/10/2011	Structural and vegetative diversity	30	30
580	3	8/18/2011	Diversity while protecting groundwater	60	34
580	3	8/18/2011	Diversity while protecting groundwater in earthflow	60	34
580	3	8/18/2011	Diversity w/ most of stream in plantations. Gaps for hardwoods and primary productivity	60	34
580	4	8/18/2011	Structural and vegetative diversity	30	34
580	4	8/18/2011	Structural and vegetative diversity	30	34
600	3	8/10/2011	Structural and vegetative diversity	30	36
600	3	8/10/2011	Understory diversity and hardwood component for primary productivity. Gap in this unit	60	36
600	3	8/10/2011	Understory and vegetative diversity	60	36
600	4	8/25/2011	Understory and vegetative diversity	30	36
600	4	8/25/2011	Understory and vegetative diversity	30	36
600	4	8/10/2011	Understory and vegetative diversity	30	36
610	4	8/25/2011	Protect groundwater. Diversity	30	35
640	3	8/25/2011	Structural and vegetative diversity	60	36
650	3	8/26/2011	Protection of groundwater and wetland area	180	34

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
650	4	8/25/2011	Protection of groundwater and wetland area	100	34
680	3	8/25/2011	Structural and vegetative diversity	60	31
680	4	8/25/2011	Structural and vegetative diversity	30	31
690	3	8/25/2011	The protection buffer will only apply to the south side of the road because the location of the site in this unit is about 100 feet from Forest Road 1985.	60	41
690	3	8/25/2011	Structural and vegetative diversity	60	41
690	4	8/25/2011	To protect a Cascades Axetail Slug site	180	41
690	4	8/25/2011	Structural and vegetative diversity	30	41
690	4	8/25/11	Structural and vegetative diversity	30	41
690	4	8/25/2011	Structural and vegetative diversity	30	41
690	4	8/25/2011	Structural and vegetative diversity	30	41
720	3	9/8/2011	Recommend 180' NC for aquatics; OK to thin to 60' for other resources	180	38
720	4	9/27/2011	Vegetative diversity	30	38
740	3	9/8/2011	Recommend 180' NC for aquatics; OK to thin to 60' for other resources	180	43
760	3	8/30/2011	Stability of inner gorge. Development of future LWD while protecting near-stream sources	90	34
760	4	8/30/2011	Stability of inner gorge. Development of future LWD while protecting near-stream sources	90	34
760	4	8/31/2011	Structural and vegetative diversity	30	34
770	3	9/8/2011	Recommend 60' NC on north side to increase tree growth/hardwoods/understory but protect shade; 180' NC on south side for stability	60	32
770	3	8/25/2011	Vegetative diversity	60	32
770	4	9/8/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity	10	32
770	4	9/9/2011	Recommend 30' NC to increase hardwoods/understory for stream productivity	30	32
780	2	9/8/2011	Recommend 180' NC for aquatics; OK to thin to 60' for other resources	180	49
790	2	9/9/2011	Recommend 90' NC on south side to increase tree growth/hardwoods/understory but protect shade; 300' NC on north side to protect unstable ground	90 and 300	33
790	4	9/9/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity but protect bank trees	10	33
800	4	9/9/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity but protect bank trees	10	46
820	3	8/30/2011	Min. Mostly plantations. Diversity	60	44
820	3	9/8/2011	Recommend 180' NC for aquatics; OK to thin to 60' for other resources	180	44
820	4	9/17/2012	Diversity while protecting channel morphology	60	44
830	3	8/30/2011	Min. Mostly plantations. Diversity	60	30

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
830	4	8/27/2012	Structural and vegetative diversity	60	30
840	2	9/16/2012	> RR No Cut for steep steam channel sides	360	31
840	4	9/17/2012	Diversity while protecting channel morphology	60	31
840	4	9/17/2012	Diversity while protecting channel morphology	60	31
840	4	9/17/2012	Structural and vegetative diversity	30	31
840	4	8/27/2012	Structural and vegetative diversity	30	31
850	4	8/27/2012	Structural and vegetative diversity	30	35
860	3	8/30/2011	Protect draw while developing diversity	60	48
860	4	8/30/2011	Steep draw needs protecting	60	48
860	4	8/30/2011	Structural and vegetative diversity	30	48
860	4	8/30/2011	Diversity while protecting groundwater	30	48
890	4	8/18/2011	Diversity and stability	60	63
980	4	9/28/2011	Plantation dominated. Diversity	30	36
980	4	9/29/2011	Plantation dominated. Diversity	30	36
980	4	9/18/2011	Structural and vegetative diversity	30	36
990	3	8/30/2011	Diversity while protecting near-stream resources	90	45
990	4	9/27/2011	Structural and vegetative diversity	30	45
1020	4	9/28/2011	Plantation dominated. Diversity	30	45
1020	4	9/26/2011	Structural and vegetative diversity	30	45
1030	4	9/26/2011	Structural and vegetative diversity	30	29
1060	3	8/27/2012	Thinning for future large tree structure	60	35
1060	3	8/27/2012	Thinning for future large tree structure and vegetative diversity	60	35
1060	4	8/27/2016	The Riparian Reserve for this creek overlaps the top of the unit and the creek itself is outside the unit. Thinning for future large tree structure and vegetative diversity	30	35
1070	3	8/27/2012	Thinning for future large tree structure and vegetative diversity	60	46
1090	4	8/27/2012	Thinning for future large tree structure and vegetative diversity	30	31
1100	2	8/26/2012	No treatment in RR	360	49
1100	3	8/27/2012	Thinning for future large tree structure	60	49
1100	3	10/29/2012	Thinning for future large tree structure and diversity. Leave higher amount of down wood in Riparian Reserve	60	49
1100	4	10/30/2012	Increase hardwoods and understory diversity	30	49
1100	4	10/31/2012	Increase hardwoods and understory diversity	30	49
1100	4	10/29/2012	Recommend 30' NC to increase hardwoods/understory	30	49
1100	4	10/29/2012	Recommend 30' NC to increase hardwoods/understory	30	49
1110	4	10/29/2012	Wildlife would like a quarter acre gap	30	33
1120	4	10/29/2012	Recommend 30' NC to increase hardwoods/understory	30	29

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
1130	3	10/29/2012	Thinning for wildlife and stand diversity	60	46
1130	4	10/29/2012	Thinning for wildlife and stand diversity	30	46
1130	4	10/29/2012	Thinning for wildlife and stand diversity	30	46
1160	2	10/29/2012	Soils issue recommends 360 NC buffer	360	35
1160	3	10/29/2012	Thinning for wildlife and stand diversity	60	35
1160	3	10/29/2012	For aquatic and soil protection	180	35
1190	4	10/29/2012	Structural and vegetative diversity	30	51
1200	4	9/28/2011	Diversity while protecting groundwater	30	31
1200	4	9/28/2011	Diversity while protecting groundwater	30	31
1200	4	9/28/2011	Structural and vegetative diversity	60	31
1200	4	9/28/2011	Diversity while protecting groundwater	30	31
1240	4	9/27/2011	Diversity. Stability	60	32
1290	3	10/31/2012	Structural and vegetative diversity	90	44
1290	4	10/31/2012	Structural and vegetative diversity	30	44
1290	4	10/31/2012	Structural and vegetative diversity	30	44
1290	4	10/31/2012	Structural and vegetative diversity	60	44
1310	3	9/19/2012	Structural and vegetative diversity	60	36
1310	4	9/19/2012	Structural and vegetative diversity	30	36
1320	2	9/19/2012	Keep 180 on class 2	180	47
1320	3	9/20/2012	Structural and vegetative diversity	60	47
1320	4	10/24/2012	Structural and vegetative diversity	30	47
1330	2	10/25/2012	Keep 180 on class 2	180	32
1330	3	10/24/2012	Structural and vegetative diversity	60	32
1330	4	10/25/2012	Structural and vegetative diversity	30	32
1330	4	10/24/2012	Structural and vegetative diversity	30	32
1340	2	9/19/2012	Keep 180 on class 2	180	39
1340	4	10/24/2012	Structural and vegetative diversity	30	39
1340	4	10/24/2012	Structural and vegetative diversity	30	39
1350	4	10/24/2012	Structural and vegetative diversity	30	40
1350	4	10/24/2012	Structural and vegetative diversity	30	40
1370	2	9/19/2012	Keep 180 on class 2	180	32
1370	4	9/20/2012	Structural and vegetative diversity	30	32
1380	4	9/21/2012	Structural and vegetative diversity	30	47
1410	4	8/22/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity but protect bank trees	10	72
1410	4	8/22/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity but protect bank trees	10	72
1430	4	8/22/2011	Recommend 30' NC or top of terrace, whichever is greater	30	33

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
1430	4	8/22/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity but protect bank trees	10	33
1430	4	8/22/2011	Recommend 10' NC to increase hardwoods/understory for stream productivity but protect bank trees	10	33
1430	4	8/22/2011	Recommend 30' NC or top of terrace, whichever is greater	30	33
1490	3	9/18/2012	Structural and vegetative diversity	60	34
1490	3	9/18/2012	Keep 180	180	34
1490	4	9/18/2012	Keep 180	180	34
1500	3	9/18/2012	Keep 180	180	31
1500	3	9/18/2012	180 for aquatic and soil resources	180	31
1540	3	10/23/2012	Develop diversity while protecting channel	90	43
1570	2	9/19/2012	Keep 180	180	34
1570	3	9/13/2011	Structural and vegetative diversity	60	34
1570	3	9/13/2011	Structural and vegetative diversity	60	34
1570	3	9/13/2011	Structural and vegetative diversity	60	34
1570	4	9/13/2011	Structural and vegetative diversity	30	34
1570	4	9/14/2011	Structural and vegetative diversity	30	34
1570	4	9/15/2011	Structural and vegetative diversity	30	34
1570	4	9/13/2011	Structural and vegetative diversity	30	34
1570	4	9/13/2011	Structural and vegetative diversity	30	34
1570	4	9/13/2011	Structural and vegetative diversity	30	34
1610	3	6/21/2011	Develop future LWD and vegetative diversity while protecting near-stream sources	60	27
1850	3	8/6/2012	Diversity while protecting near-stream habitat	60	33
1850	4	8/6/2012	Stand development	30	33
1890	4	8/7/2012	ACS objectives being met	180	129
1890	4	8/6/2012	ACS objectives being met	180	129
1910	3	9/11/2012	Recommend 180' NC for aquatics; OK to thin to 30/60' for other resources	180	40
1920	2	9/12/2012	Thinning secondary for wildlife structure	180	35
1920	3	9/12/2012	Hardwood, understory, and tree growth	60	35
1920	3	9/12/2012	Thinning for wildlife structure	60	35
1930	2	9/12/2012	Thinning secondary for wildlife structure	180	36
1930	3	9/12/2012	Thinning for wildlife structure	60	36
1930	3	9/12/2012	Hardwood, understory, and tree growth	60	36
1930	3	9/12/2012	Thinning for wildlife structure	60	36
1930	3	9/12/2012	Thinning for wildlife structure	60	36
1930	3	9/12/2012	For groundwater protection and wildlife needs	180	36
1930	3	9/12/2012	To protect seeps	180	36

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
1930	3	9/12/2012	For groundwater protection and wildlife needs	180	36
1930	4	9/13/2012	Thin outside of RR for wildlife diversity	180	36
1930	4	9/12/2012	Keep 180	180	36
1940	2	9/12/2012	Thinning secondary for wildlife structure	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	3	9/12/2012	For groundwater protection and wildlife needs	180	37
1940	4	9/12/2012	Minimal hardwoods in unit	30	37
1940	4	9/12/2012	Keep 180 NC	180	37
1940	4	9/12/2012	Minimal hardwoods in unit	30	37
1950	3	9/18/2012	Thin to 60' for wildlife and diversity	60	
1950	3	9/18/2012	Thinning for wildlife diversity	60	35
1950	4	9/19/2012	Structural and vegetative diversity	30	35
1950	4	9/18/2012	Minimal hardwoods in unit	30	35
1950	4	9/18/2012	Minimal hardwoods in unit	30	35
1950	4	9/18/2012	Minimal hardwoods in unit	30	35
1960	3	9/18/2012	Thin to 60' for wildlife and diversity	60	36
1960	4	9/18/2012	Minimal hardwoods in unit	30	36
1960	4	9/18/2012	Minimal hardwoods in unit	30	36
1960	4	9/18/2012	Minimal hardwoods in unit	30	36
1980	4	10/23/2012	Structural and vegetative diversity	30	41
1980	4	10/24/2012	Structural and vegetative diversity	30	41
1980	4	10/23/2012	Promotes RR diversity while protecting soil and channel	180	41
5030	1	9/11/2012	Recommend 90' NC to increase tree growth but protect shade	90	40
5030	2	9/5/2012	Recommend 90' NC to increase tree growth but protect shade; thinning for wildlife in remainder of RR; fall and leave treatment This is the research stream	90	40
5030	4	9/11/2012	Recommend 180' NC for aquatics;	180	40
5030	4	9/11/2012	Recommend 30' NC to increase hardwoods/understory	30	40
5030	4	9/11/2012	Recommend 30' NC to increase hardwoods/understory	30	40
5030	4	9/12/2012	Recommend 30' NC to increase hardwoods/understory	30	40
5030	4	9/11/2012	Recommend 30' NC to increase hardwoods/understory	30	40
5030	4	9/5/2012	Recommend 30' NC to increase hardwoods and tree growth	30	40
5030	4	9/5/2012	Recommend 30' NC to increase hardwoods and tree growth	30	40

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
5030	4	9/6/2012	Recommend 30' NC to increase hardwoods and tree growth	30	40
5040	4	8/30/2012	Recommend 30' NC to increase hardwoods and tree growth	30	38
5050	2	9/5/2012	Keep 180	180	27
5050	4	9/6/2012	Recommend 30' NC to increase hardwoods and tree growth	30	27
5080	2	8/10/2012	Recommend 90' NC to increase tree growth	90	38
5080	3	8/10/2012	Recommend 60' NC to increase tree growth	60	38
5080	4	8/10/2012	Recommend 30' NC to increase hardwoods/understory	30	38
5080	4	8/10/2012	Recommend 30' NC to increase hardwoods	30	38
5080	4	8/10/2012	Recommend 30' NC to increase hardwoods/understory	30	38
5080	4	9/5/2012	Recommend 30' NC to increase hardwoods/understory	30	38
5090	1	8/10/2012	Recommend 90' NC to increase tree growth	90	30
5090	2	8/10/2012	Recommend 90' NC to increase tree growth	90	30
5090	2	8/10/2012	Recommend 180' NC to stay out of inner gorge; fall and leave within NC	180	30
5090	4	9/5/2012	Recommend 180' NC; OK to thin to 30' for other resources	180	30
5090	4	9/5/2012	Recommend 180' NC for aquatics; debris chute - min 60' for soil protection	180	30
5090	4	9/5/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	30
5090	4	9/5/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	30
5090	4	8/10/2012	Recommend 30' NC to increase hardwoods/understory	30	30
5090	4	8/10/2012	Recommend 30' NC to increase hardwoods	30	30
5090	4	9/5/2012	Recommend 30' NC to increase hardwoods/understory	30	30
5110	4	8/31/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	33
5110	4	8/31/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	33
5110	4	8/31/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	33
5110	4	8/31/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	33
5120	4	8/2/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	30	36
5120	4	8/2/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5130	4	8/2/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	30	34
5140	4	8/2/2012	Recommend 30' NC to increase hardwoods/understory for productivity	30	36
5160	4	8/30/2012	Recommend 30' NC to increase hardwoods/understory	30	35
5160	4	8/30/2012	Recommend 30' NC to increase hardwoods/understory	30	35
5160	4	8/30/2012	Recommend 30' NC to increase hardwoods/understory	30	35

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
5160	4	8/30/2012	Recommend 30' NC to increase hardwoods; keep out of terrace	30	35
5170	1		Recommend 180' NC to stay out of S. Fork floodplain below road	180	34
5170	3	8/29/2012	Recommend 180' NC for aquatics; OK to thin to 60/90 for other resources	180	34
5170	3	8/29/2012	Recommend 180' NC for aquatics; OK to thin to 60/90 for other resources	180	34
5180	3	8/29/2012	Recommend 180' NC for aquatics; OK to thin to 60/90 for other resources	180	33
5180	3	8/29/2012	Recommend 180' NC for aquatics; OK to thin to 60/90 for other resources	180	33
5180	4	8/29/2012	Recommend 30' NC to increase hardwoods/understory for productivity	30	33
5230	2	8/10/2012	Recommend 90' NC to increase tree growth but protect shade; fall and leave w/in 90' of stream; thinning outside NC for wildlife	90	36
5230	3	8/10/2012	Recommend 60' NC to increase hardwoods/tree growth but protect shade	60	36
5230	3	8/10/2012	Recommend 60' NC to increase hardwoods/tree growth but protect shade	60	36
5230	3	8/10/2012	Recommend 60' NC to increase hardwoods/tree growth but protect shade	60	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30’ NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30’ NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30' NC to increase hardwoods/tree growth	30	36
5230	4	8/10/2012	Recommend 30’ NC to increase hardwoods/tree growth	30	36
5260	4	9/18/2012	Diversity while protecting stability	60	
5260	4	9/18/2012	Diversity while protecting stability	60	
5260	4	9/18/2012	Diversity while protecting stability	60	
5260	4	9/18/2012	Diversity while protecting stability	60	
5320	2	9/1/2014	Grasshopper Creek. No treatment needed for fisheries but ok to thin in second site potential tree height	180	33
5320	4	10/25/2012	Diversity	30	33
5320	4	10/25/2012	Diversity	30	33
5360	2	10/25/2012	Grasshopper Creek. No treatment needed.	180	31

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
5370	4	8/1/2012	Recommend 30' NC to inc hardwoods/understory for productivity	30	38
5370	4	8/19/2009	Recommend 30' NC to inc hardwoods/understory for productivity	30	38
5380	2	8/1/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources	60	35
5390	2	8/28/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources; thinning in second 90ft for wildlife/elk habitat. Research unit with gap.	90	34
5390	4	8/28/2012	Recommend 30' NC to increase hardwoods/understory	30	34
5400	3	8/28/2012	Recommend 60' NC to increase hardwoods/understory	60	
5400	4	8/28/2012	Recommend 30' NC to increase hardwoods/understory	30	
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5410	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	36
5420	1	7/2/2012	90' NC w/ group fall and leave near stream; outside the 90' NC, 2 ac gaps for wildlife	90	41
5420	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	41
5420	4	7/2/2012	Recommend 30' NC to increase hardwoods/understory	30	41
5420	4	6/12/2012	Recommend 30' NC to increase hardwoods/understory	30	41
5420	4	7/2/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	41
5420	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	41
5420	4	7/27/2012	Recommend 30' NC to increase hardwoods/understory	30	41
5420	4	7/27/2012	Recommend 30’ NC to increase hardwoods/understory	30	41
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	
5430	3	6/29/2012	Keep 180'	180	

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
5440	1	6/12/2012	90' NC w/ group fall and leave near stream; outside the 90' NC, 2 ac gaps for wildlife	90	37
5440	3	6/12/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources to protect adjacent wet pockets	180	37
5440	4	7/2/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources to protect adjacent wet pockets	180	37
5440	4	7/2/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources to protect adjacent wet pockets	180	37
5440	4	7/2/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources to protect adjacent wet pockets	180	37
5440	4	7/2/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources to protect wet pockets	180	37
5440	4	7/2/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources to protect wet pockets	180	37
5450	3	6/27/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	33
5450	4	6/27/2012	Recommend 30' NC to increase hardwoods/understory for stream productivity	30	33
5460	1	6/12/2012	90' NC w/ group fall and leave near stream; outside the 90' NC, 2 ac gaps for wildlife	90	36
5460	3	6/12/2012	Recommend 180' NC for aquatics; OK to thin to 60' for other resources	180	36
5460	4	6/12/2012	Recommend 180' NC for aquatics; OK to thin to 30' for other resources	180	36
5460	4	02010612	Recommend 30' NC to increase tree growth/ hardwoods/understory	30	36
5470	1	6/12/2012	90' NC w/ group fall and leave near stream; outside the 90' NC, 2 ac gaps for wildlife	90	37
5470	3	6/12/2012	Recommend 30' NC to increase hardwoods/understory but protect shade	30	37
5470	4	6/12/2012	Recommend 30' NC to increase hardwoods/understory for stream productivity	30	37
5470	4	6/12/2012	Recommend 30' NC to increase hardwoods/understory for stream productivity	30	37
5600	3	9/20/2012	Protect actively unstable area while creating diversity for wildlife	90	
5600	4	9/20/2012	Diversity	30	
5800	3	9/4/2012	No treatment in RR	180	139

Appendix H – Hardwood Analysis

Deciduous leaves have a higher nutritional quality than coniferous needles. To better understand the current and future conditions of vegetation diversity, a "hardwood analysis" was conducted for all of the Riparian Reserves in the South Fork McKenzie River watershed. This analysis used satellite imagery (WorldView 2) collected on July 19, 2013 and Google Earth imagery. The analysis found that only 3.2% of the Riparian Reserves in the entire South Fork McKenzie had a deciduous and deciduous/shrub component (see Table H2 below). Upstream of Cougar Dam only 3.0% of the Riparian Reserve area is deciduous and deciduous/shrub. An analysis of the current coniferous versus hardwood component of the Riparian Reserves shows little difference between wilderness and non-wilderness. However, wildfires have been suppressed within the Wilderness for over 100 years which have also altered their riparian conditions. In addition, late-seral and old growth stands have numerous natural gaps which are frequently colonized by deciduous species (Warren 2013).

Since the acres of old growth across the watershed have been reduced over the last century, it can be assumed that so has the deciduous component. These gaps would have created a mixed deciduous and conifer stand. Within Riparian Reserves of the South Fork McKenzie watershed, there is currently less than 5 percent combined deciduous tree and shrubs and mixed deciduous with conifer. Although an exact historic range of variability for deciduous composition is unknown at this time, a study of riparian plant communities in northwest Oregon (McCain 2004) provides some indication of "relatively unmanaged" conditions. The study describes riparian and upland plant communities based on geomorphic feature (e.g. in-channel, cobble bars, terraces, floodplain, etc.) and many of the Willamette study sites were located within the South Fork McKenzie watershed. On the steep banks/terraces and high terraces/major floodplain features, deciduous trees (red alder and big leaf maple) had typical percent cover values of 15-64 percent (McCain 2004). Valley cross-sections (300-foot riparian transects) on 3rd and 4th order relatively unmanaged streams in the west Cascades had a hardwood basal area of 7-16 square feet/acre and the distribution of hardwoods along these transects were fairly even (i.e. hardwoods were present throughout the 300-foot transect). Studies like this suggest that in "relatively unmanaged" riparian plant communities, there is typically a hardwood, shrub, and herb component. In many of the streams surveyed in the project area, there was an obvious lack of these components. The results of the analysis at the landscape scale are corroborated by surveys at the stand scale, where dense conifers dominate Riparian Reserves and there is often a lack of understory development and species diversity.

South Fork McKenzie River Riparian Reserves Vegetation Classification Methodology
The following are modeling inputs and assumptions utilized during the analysis process:

<u>Imagery</u>
WordView 2 imagery collected on July 19, 2013 was used for creating polygons and providing spectral information for the classification. Google Earth imagery in conjunction with the WorldView 2 imagery was used to interpret training polygons.

<u>Polygon Generation</u>
eCognition software was used to generate the polygon boundaries. All 8 bands of the 2 meter Worldview 2 imagery were input. A scale parameter of 50 was used and the shape and compactness criterions were set at 0.8.

<u>Classes</u> – trees were considered greater than 2 meters in height
Water = > 80% water

Deciduous = > 80% deciduous trees
Conifer = > 80% coniferous trees
Mix = all other forest stands
Deciduous Shrub
Other = none of the above, including bare ground, forest regrowth, grass, etc.

Classification

The classification was performed in eCognition using a standard nearest neighbor algorithm using the spectral means for each polygon. Approximately 20 training sites were identified for each class. The classified polygons were then edited and dissolved for the final map. Most confusion occurred between conifer regrowth and deciduous forest, and conifer forest and mixed forest.

Figures 40 and 41 represent the various riparian vegetation classification outputs produced from the hardwood analysis. Figures 37-39 represent the approximate locations of the near-stream gaps and the corresponding vegetation classifications nearby.

Tables 62 and 63 below summarize the numerical results of the analysis. The results are solely within Riparian Reserves in the South Fork McKenzie River Watershed.

Table 65. Acres of Riparian Reserves within the South Fork McKenzie 5th Field Watershed

Total Acres	Acres Above Cougar Dam	Acres in Wilderness	Acres in Non-Wilderness Above Cougar Dam
65,445	63,670	32,738	30,932

Table 66. Riparian Reserve vegetation classification outputs.

	ACRES						PERCENT					
	Deciduous	*Deciduous shrub*	*Conifer*	*Mix*	*Other*	*Water*	*Deciduous*	*Deciduous shrub*	*Conifer*	*Mix*	*Other*	*Water*
5th Field Watershed Riparian Reserve	1249	828	57215	1243	3135	1775	1.9	1.3	87.4	1.9	4.8	2.7
Riparian Reserves above Cougar Dam	1063	828	56053	989	3009	1728	1.7	1.3	88.0	1.6	4.7	2.7

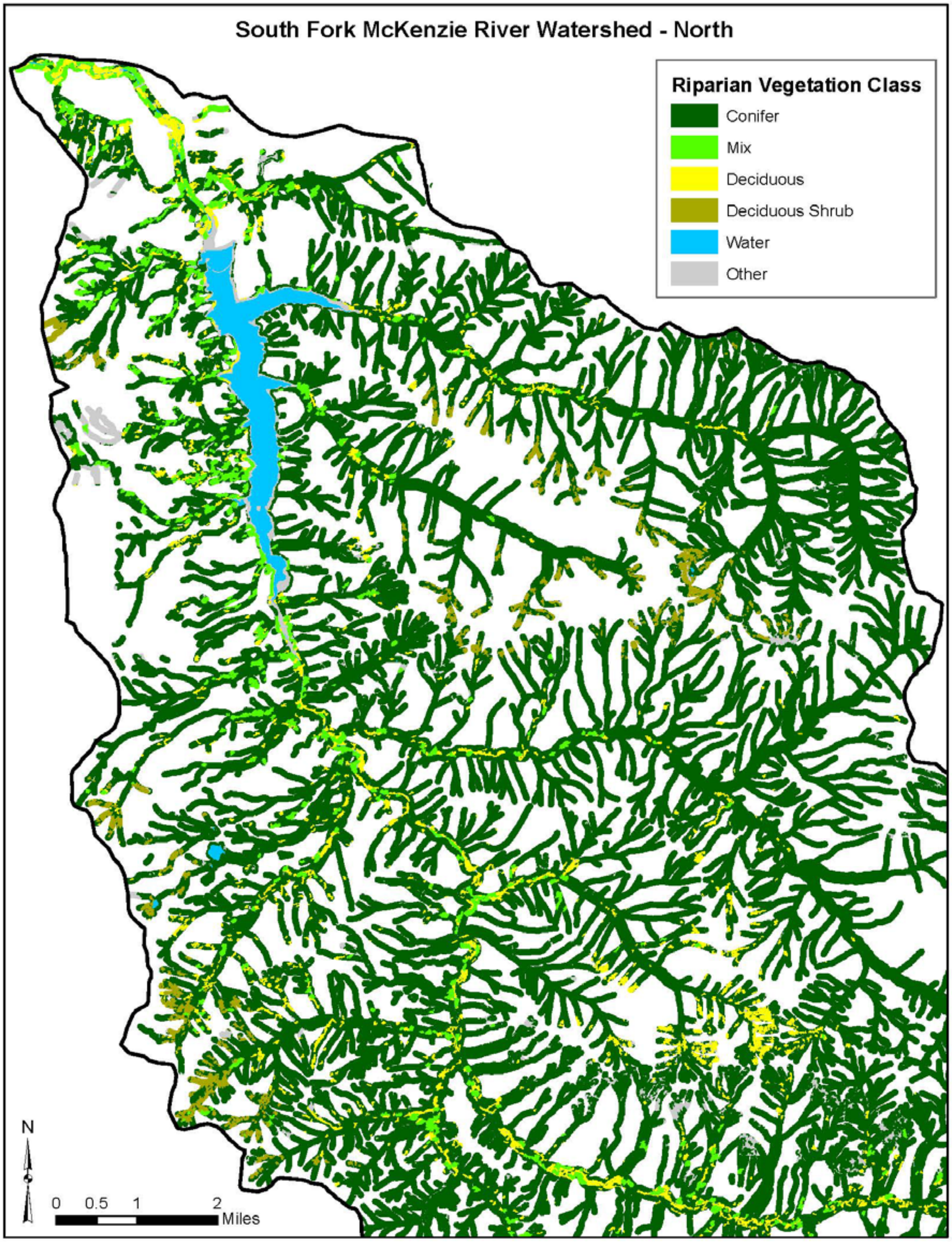


Figure 40. Riparian Reserve Vegetation Classification (North)

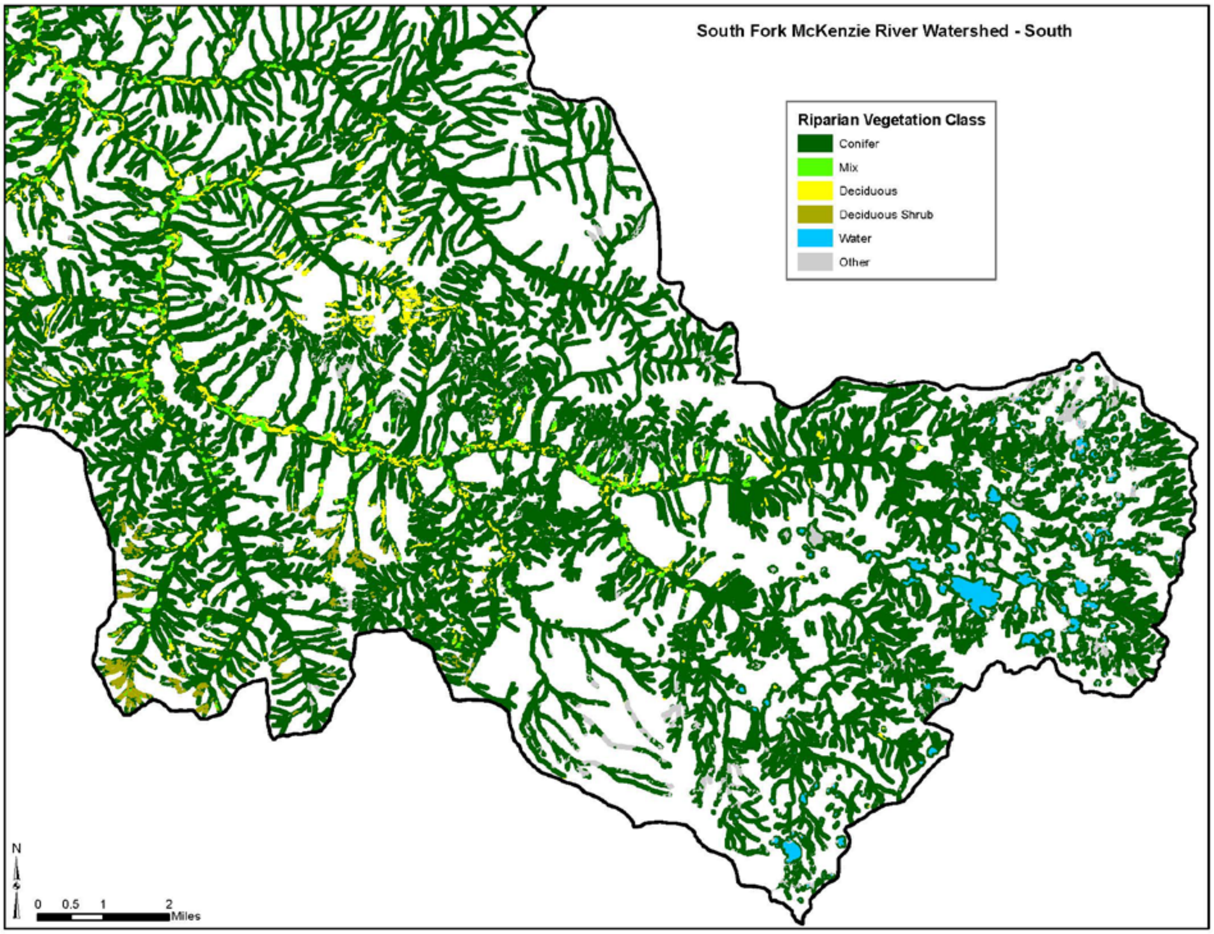


Figure 41. Riparian Reserve Vegetation Classification (South)

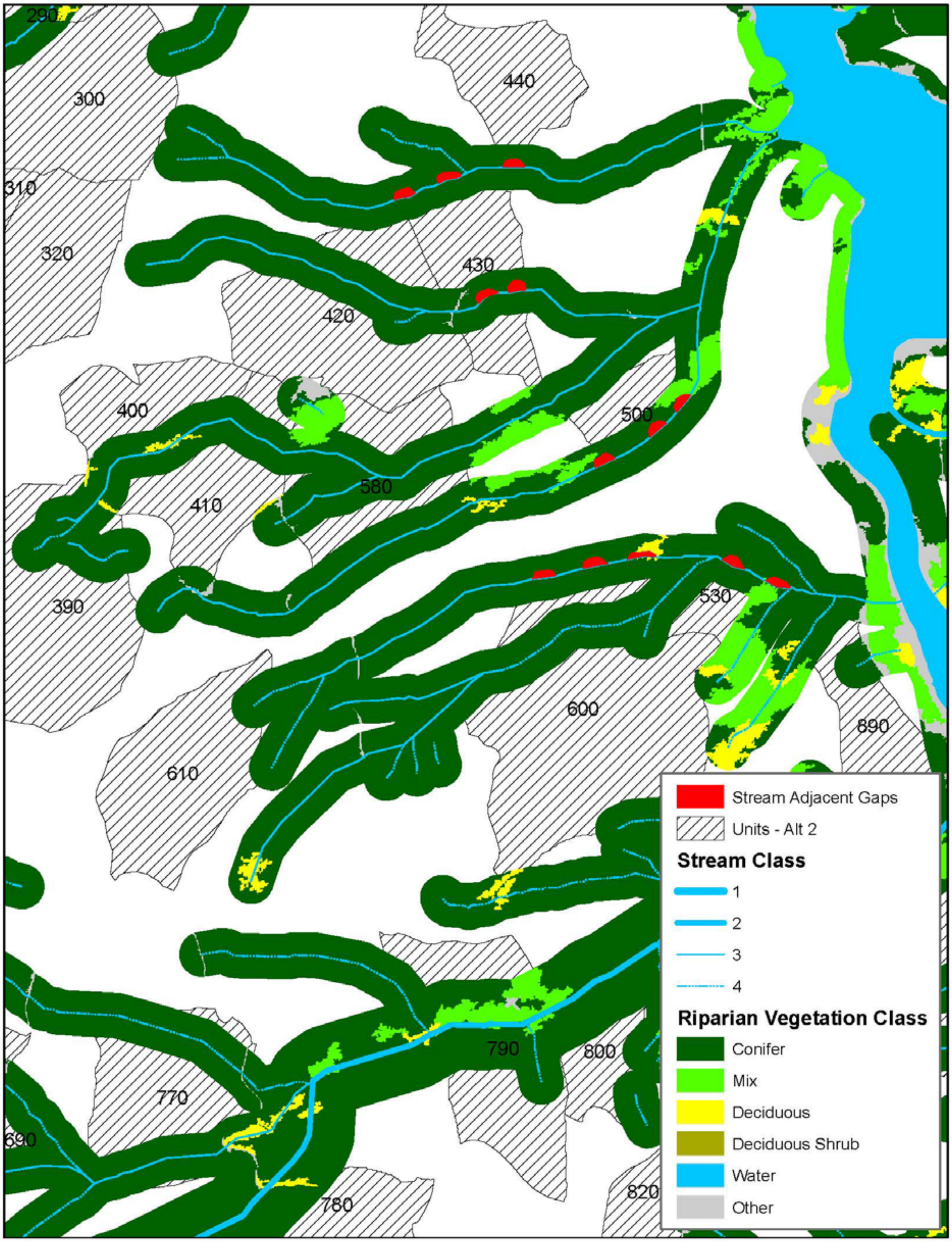


Figure 42. Hardwood Gaps #1

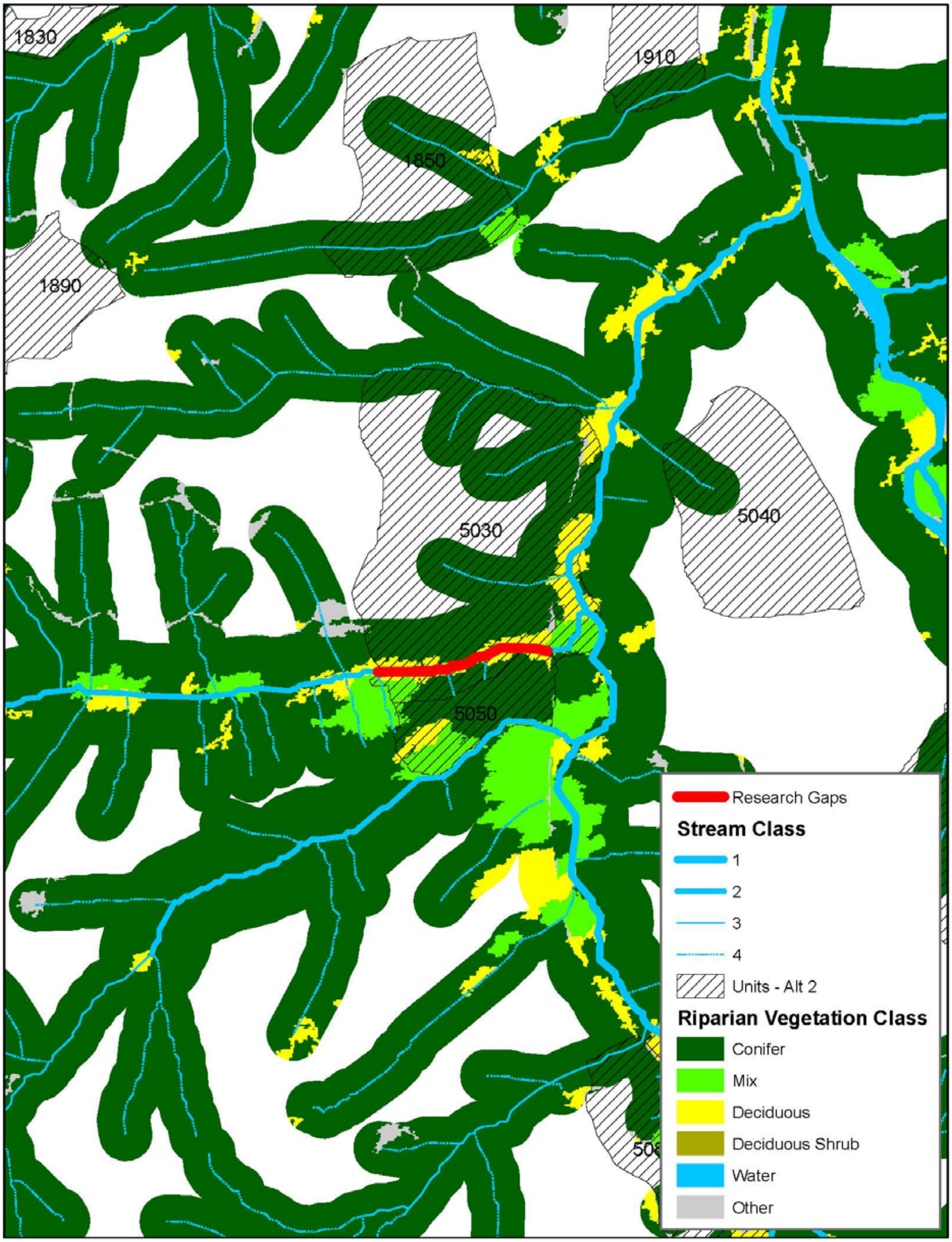


Figure 43. Hardwood Gaps #2

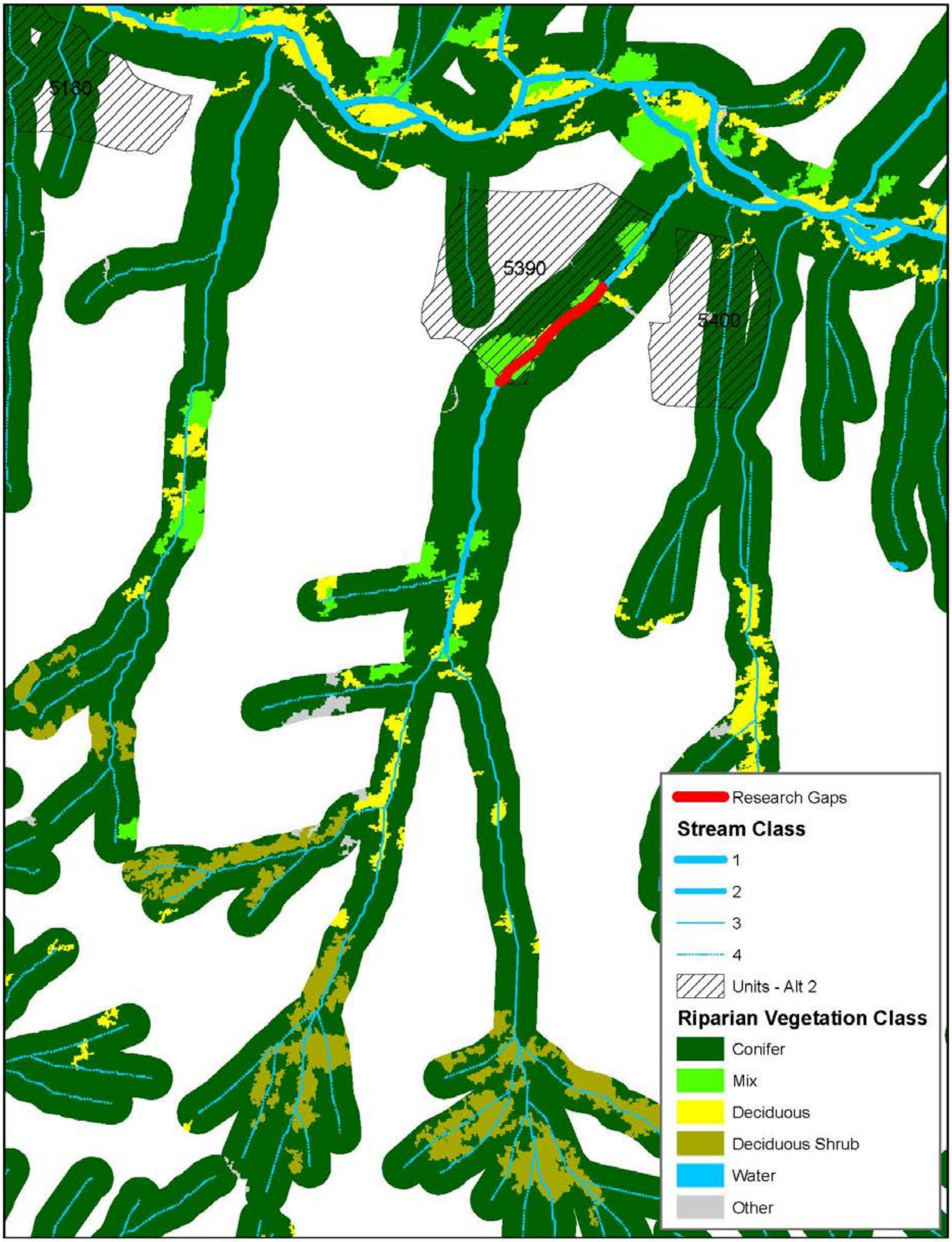


Figure 44. Hardwood Gaps #3

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Glossary

A

Advanced Regeneration - Small trees, usually less than 1 inch in diameter, which are growing under mature trees prior to planned harvest activities.

Air Quality The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations. Used instead of "air pollution" when referring to programs.

Allochthonous Energy Sources - Allochthonous energy sources are those derived from outside the stream system, that is, from the terrestrial environment. Leaves, twigs, fruits, etc. are typical forms that enter the water by direct litterfall or lateral leaf blow.

Ambient Air Quality- defined under the Clean Air Act as the air quality outside of industrial site boundaries

Arterial Road – A forest road that provides service to large land areas and usually connects with other arterial roads or public highways. (FSH 7709.54, no longer in print)

Autochthonous Energy Sources Autochthonous energy sources are those derived from within the stream system. During photosynthesis, for example, primary producers form organic carbon compounds out of carbon dioxide and inorganic matter. The energy they produce is important for the community because it may be transferred to higher trophic levels via consumption.

C

Canopy - The uppermost spreading branchy layer of a forest.

Canopy Base Height – The height above the ground of the first canopy layer where the density of the crown mass within the layer is great enough to support vertical movement of a fire. Low canopy base heights have been shown to initiate crown fire behavior.

Canopy Bulk Density - Canopy bulk density (CBD) describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit.

Canopy Cover - Canopy cover is a measure of the percentage of ground covered by a vertical projection of the tree canopy.

Canopy Closure - Canopy closure is the proportion of the sky hemisphere (measured from all angles) obscured by vegetation when viewed by a single point. Closure is affected by tree heights and canopy widths and takes into account light interception and other factors that influence microhabitat.

Chain – A standard measurement equal to 66 feet.

Class I Airsheds - Geographic areas designed by the Clean Air Act subject to the most stringent restrictions on allowable increment of air quality deterioration. Class I areas include Forest Service wildernesses and nation memorial parks over 5,000 acres, National Parks exceeding 6,000 acres, international parks, as well as other designated lands.

Cohort – A group of trees developing after a single disturbance, commonly consisting of trees of similar age, although it can include a considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance.

Condition Classes - A function of the degree of departure from historical fire regimes. Condition class 1 is within or near historical conditions; class 3 is significantly altered from historical regimes.

Contiguous- In close proximity to or near.

Core Area - 0.5 mile (radius circle) around a known or predicted owl site, which delineates the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham and Noon (1997) defined the core area as that portion of a northern spotted owl home range that received disproportionately high use for nesting, roosting and access to prey; they suggested that 60-70% of owl reproducing season activity occurred in about 20% of the home range. Although Courtney et al. (2004:5-5) observed that core area sizes varied greatly among owls, Thrailkill (pers. com.) determined that Bingham and Noon 1997, Wagner and Anthony 1999, Franklin et al. 2000 and Irwin et al. 2004 collectively suggested a core area of about 500 acres.

Collector Road - A forest road that serves smaller land areas than an arterial road. Usually connects forest arterial roads to local forest roads or terminal facilities. (FSH 7709.54, no longer in print)

Critical Habitat – The critical habitat designation is conducted by the U.S. Fish and Wildlife Service and is based on the current status and recent scientific research on northern spotted owl populations. Critical habitat was identified for specific areas within the geographical area occupied by the species at the time it was listed, on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection. For the northern spotted owl, these features include particular forest types that are used or likely to be used by northern spotted owls for nesting, roosting, foraging, or dispersing habitat. In addition, the best available information was used to identify those areas that are otherwise determined to be essential to the conservation of the species. A habitat network was identified that meets the following criteria: • Ensures sufficient habitat to support stable, healthy populations across the range, and also within each of the 11 recovery units; • Ensures distribution of northern spotted owl populations across the range of habitat conditions used by the species; • Incorporates uncertainty, including potential effects of barred owls, climate change, and wildfire disturbance risk; and • Recognizes that these protections are meant to work in concert with other recovery actions, such as barred owl management.

Crop Trees -Trees which are considered suitable to meet long term management objectives for an analysis area. These may also be referred to as healthy or manageable trees. This may include both the physical make-up of the tree as well as the species.

Cycle - As applied to uneven-aged management, it is the time interval between harvest entries. It should be noted that harvest entries in uneven-aged management are to leave residual levels of growing stock which should not need treatment for at least one cycle length.

D

Desirable Species - Any species of plant or animal which is considered to be compatible with meeting management goals and objectives.

Discounted Cost - Value of all cost associated with a project over its lifetime multiplied by a discount rate to determine the costs at today’s worth.

Discounted Revenue - Value of all revenue associated with a project over its lifetime multiplied by a discount rate to determine the value today.

Net Present Value - Difference in Discounted Revenue and Discounted Cost to evaluate if a project will have a positive or negative return on investment.

Disturbance - Events that disrupt the stand structure and/or change resource availability or the physical environment (Oliver 1996).

Diameter Breast Height (DBH) – Diameter of a tree measured 4.5 feet up from the ground on the uphill side.

E

Early Seral - Plants which inhabit a disturbed site within the first few years subsequent to the disturbance.

Early Seral Habitat – A forest structural condition that lasts 15-20 years after a human disturbance such as timber harvest, or natural disturbance such as wildfire. This structural condition can provide valuable wildlife habitat components including grasses, flowering forbs, hardwoods, and dead wood habitat structures.

Emissions - A release of combustion gases and aerosols into the atmosphere.

F

Fire Behavior – The manner in which a fire reacts to the influences of fuel, weather, and topography.
Fire Intensity -The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge. The primary unit is Btu per second per foot (Btu/sec/ft) of fire front. Also, the rate of heat release per unit time per unit length of fire front. Numerically, it is the product of the heat yield, the quantity of fuel consumed in the fire front, and the rate of spread.

Fire Regime - A function of the historical frequency of fire and the degree of severity of those fires.

Fire Regime Condition Class - Depiction of the degree of departure from historical fire regimes, possibly resulting in alternations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the Fire Regime Groups. Based on the coarse-scale national data, they serve as generalized wildfire rankings. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk).

Fire Severity - Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.

Flame Length - The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity.

Fuel Class - Part of the National Fire Danger Rating System (NFDRS). Group of fuels possessing common characteristics. Dead fuels are grouped according to 1-, 10-, 100-, and 1000-hour time lag, and living fuels are grouped as herbaceous (annual or perennial) or woody.

Fuels - Vegetative matter, dead or alive, that burns in a fire. It is broadly characterized by the following categories:

- Surface or ground fuels are within a foot or so of the ground surface.
- Ladder fuels exist when you have a continuous vertical arrangement of fuel that allows fire to easily go from ground level into the tree canopy.
- Crown fuels are the tree limbs and leave that can burn with enough heat and/or wind.
- Live fuels are the green (live) herbs and shrubs.

Fuel Models - Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

G

Group Selection - A stand management method in which silviculturists identify groups of trees which need to be removed from a stand of trees in order to meet management objectives.

H

Habitat Modification; Habitat Downgraded: Refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat; Habitat Removed: Refers to silvicultural activities that 1) Alter spotted owl suitable habitat such that it no longer supports nesting, roosting, foraging, and dispersal (i.e., suitable habitat becomes non-habitat after treatment) or 2) Alter spotted owl dispersal habitat so that the habitat no longer supports dispersal (i.e., dispersal habitat becomes non-habitat after treatment).

Home Range - An estimated area for habitat use of a spotted owl pair. For the Oregon Cascades, this estimate is 1.2 miles (radius circle) around a known or predicted owl site (Thomas et al. 1990, USDI et al. 2008).

Hyporheic Flow - Hyporheic flow is the mixing of shallow groundwater and surface beneath and alongside a stream bed.

I

Incidental Take (ESA) – Take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity

Individual Tree Selection - A stand management method in which silviculturists identify individual trees that need to be removed from a stand of trees. In this method, specific types, sizes, or qualities of trees are identified for either removing from the stand or remaining in the stand.

Initial Attack – The fire suppression effort that takes place as soon as possible following a wildland fire report.

Invasive Weed – see Noxious Weeds

K

Known Owl Site - A site that was or is occupied by a pair or resident single as defined by the survey protocol (1990-2012). The specific site location is determined by the unit biologist based on the best and/or most recent information. A known site may be determined to be inactive only in accordance with the

L

Ladder Fuels – Fuels that provide vertical continuity between the ground and tree crowns which create a pathway for a surface fire to move into the overstory tree crowns.

Local Road – A forest road that connects terminal facilities with forest collector, forest arterial or public highways. Usually forest local roads are single purpose transportation facilities. (FSH 7709.54, no longer in print)

M

Macrophyte - A macrophyte is an aquatic plant that grows in or near water and is emergent, submergent, or floating. In lakes and streams macrophytes provide cover for fish and substrate for aquatic invertebrates, produce oxygen, and act as food for some fish and wildlife.

Mechanical Thinning - Reducing the number of trees in a stand using a factor which is independent of tree quality. The use of spacing for thinning is one type of mechanical treatment. For example, the closest tree to the points of a 15' by 15' grid would be left, regardless of tree quality.

Microbes - A microbe is a microscopic organism, which may be a single cell or multicellular organism. Microbes are very diverse and include all the bacteria and archaea and almost all the protozoa. They also include some members of the fungi, algae, and animals such as rotifers.

Motor Vehicle Use Map (MVUM) – A map reflecting designated roads, trails and areas on an administrative unit or a Ranger District of the National Forest System. (36 CFR 261.2)

Multi-Cohort – a stand with two or more age classes or cohorts.

N

Nest Patch (or Stand) - 300 meters (radius circle) around a known or predicted owl site, where a spotted owl would be likely to select a nest tree. This is based on habitat usage of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest.

Net Present Value - Difference in Discounted Revenue and Discounted Cost to evaluate if a project will have a positive or negative return on investment.

Noxious Weeds (Invasive species) - Non-native plants listed by the State that generally have either economic or ecosystem impacts, or are poisonous to wildlife and/or livestock. They aggressively invade disturbed areas such as fires, road sides, and construction areas.

O

Obligate Predator - When the word is used as an adjective, obligate means "by necessity" (the antonym is *facultative*) and is used mainly in biology. An obligate predator is an organism whose survival is dependent on a diet consisting of animal flesh. In the case of aquatic insects these organisms would primarily eat other insects.

Off-Highway Vehicle (OHV) – Describes all those vehicles designed for off-highway use and which are classified as one of four classes of ATV in Oregon. (OHV Guide 2014)

P

Particulate Matter - known as particle pollution or PM, is a microscopic complex mixture of extremely small particles and liquid droplets and contains a “number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mold spores). Fine particles, such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller (EPA website),

Percentile Weather - The weather conditions that can be expected of X% of the days during a fire season. The standard percents are Low (0%-15%), Moderate (16%-89%), High (90%-96%) and Extreme (97%+). For example, low percentile weather is the average suite of weather conditions that would occur less than 15% of the time.

Periphyton - Periphyton is a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus that is attached to submerged surfaces in most aquatic ecosystems. It serves as an important food source for invertebrates, tadpoles, and some fish.

Phytophagous - Feeding on plant material. This term is typically used when referring to insects.
Predicted Owl Site - An area able to support resident spotted owls (i.e. a potential breeding pair) as determined by the USDI et al. (2008) northern spotted owl occupancy template. This is used for determining effects to spotted owls where survey data are insufficient.

Prescribed Fire Burn Plan - A plan required for each fire application ignited by management. Plans are documents prepared by qualified personnel, approved by the agency administrator, and include criteria for the conditions under which the fire will be conducted (a prescription). Plan content varies among the agencies.

Prescribed Fire - Fire which is planned and used as a tool to meet specific management objectives.

Primitive Unconfined Recreation- From the Wilderness Act of 1964 and which describes the concept of freely accessed recreational opportunities with minimal interruption to such activity either physically, socially or due to administrative actions implemented by a land management agency such as seasonal closures, group size restrictions, fees, permitting systems or other restrictions.

Probability of Ignition (POI) - The chance that a firebrand will cause an ignition when it lands on receptive fuels.

Problem Fire - Problem fires are wildfires that, because of extreme fire behavior, present a high risk to human safety and loss of forest resources.

R

Rate of Spread (Fire Behavior) - The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

Redd - A fish nest made of gravel, consisting of a depression hydraulically dug by a fish for egg deposition (and then filled) and associated gravel mounds.

Remnant trees - Large to giant-diameter trees within younger-aged stands, that lived through past natural fire disturbances, or were retained after logging. Amounts and distribution of remnant trees within younger stands may be highly variable.

Road – A motor vehicle route over 50 inches wide, unless identified and managed as a trail. (36 CFR 212.1)

Road Decommissioning – Activities that result in the stabilization and restoration of unneeded roads to a more natural state. (36 CFR 212.1)

Rotation - A pre-determined time frame in which an even-aged forest stand will reach maturity and be harvested.

S

Sag Pond - A sag pond is a body of water collected in the lowest parts of a depression formed either near the head scarp of rotational landslides or between two strands of an active strike-slip fault. Hidden Lake sits on a deep seated earthflow and is technically a sag pond.

Salvage - Activity, usually removal or chipping, of material killed by a disturbance event such as insects, fire, wind, etc. Where possible, this material is used as some form of forest product of commercial value, such as firewood, pulp, and/or chips.

Seral Stages - Seral stage describes the phase of development of a plant community. Early seral species are those species you would expect to find on a site soon after a major disturbance, like fire. These are species such as pines, Douglas-fir, snowbrush, fireweed, etc. They are generally shade intolerant species. Late seral are the species that can come in under a fully developed vegetative canopy, such as true firs, prince's pine, lichens, etc.

Silviculture -The theory and practice of directing forest establishment, composition, and growth for the production of forest resources to meet specific management objectives. The word is derived from the Latin word silva, which means "forest" and from cultura, which means "to develop and care for." So, it is the development and caring for the forest.

Silviculturist - One, who plans, assists in and supervises the implementation of silviculture projects. The Silviculturist determines (prescribes) the vegetative treatments necessary to meet the objectives for vegetation on a given site.

Site - A specific location where management activity is considered, planned, or operating.

Site Potential - The specific ability of a site to grow vegetation. It includes the soil, topographic, and climatic conditions that determine the resources available for growing vegetation.

Site Preparation - The removing or rearranging of vegetation or woody debris to meet specific management objectives. Most often it is used to describe the process(es) used to expose mineral soil areas suitable for planting or seeding desirable species of plants.

Slash - Debris resulting from such natural events as wind, fire, or snow breakage; or such human activities as road construction, logging, pruning, thinning, or brush cutting. It includes logs, chunks, bark, branches, stumps, and broken understory trees or brush.

Smoke Sensitive Receptor Areas (SSRA) - Area in which smoke from outside sources is intolerable, for reasons such as heavy population, existing air pollution, or intensive recreation or tourist use.

Soundscape- Geographic region as defined by the audible sounds associated within it.

Spotted Owl Habitat Types – **Suitable habitat** consists of forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90%); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly.
Foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS 2011c, p. A-10).
At a minimum, **dispersal habitat** consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS 2011c, p. A-10). It consists of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (dbh) with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that will provide some roosting and foraging opportunities during the colonization phase of dispersal, but not at a scale that would support nesting pairs (in which case it would be classified as suitable habitat). Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. However, in this document, dispersal habitat generally refers to stands that are 40-79 years old.

Stand - A group of trees of similar canopy structure, species composition, and/or size growing on a continuous area. A stand is distinct from neighboring stands in structure, growing conditions, or management objectives. Stand age for this project is averaged and based on trees of commercial size which is seven inch DBH and greater.

Stand Density Index – SDI – A relative density measure based on the relationship between mean tree size and number of trees per unit area in a stand (Reineke 1933).

Stand Dynamics - The changes in forest stand structure with time, including stand behavior during and after disturbances (Oliver 1996).

Stand Structure - The physical and temporal distribution of trees and other plants in a stand (Oliver 1996).

Stratum – A distinct layer of vegetation within a forest community; canopy layer.

Stream Classes - Class 1 and 2 = perennial fish bearing streams; Class 3 = perennial non-fish bearing streams; Class 4 = intermittent, seasonally flowing streams.

Suppression - All the work of extinguishing or confining a fire beginning with its discovery.

T

“Take” of ESA listed species - Take: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.

Thinning - Any cutting or removal of vegetation (trees, brush, etc.) resulting in a reduction of competition for water, light, and/or nutrients between individual plants.

- Commercial thinning refers to removing material that has an established dollar value on the open market and can be sold with at least a minimal net value sufficient to pay for the thinning activity.

Torching - The burning of the foliage of a single tree or a small group of trees, from the bottom up. Also, single tree torching is one tree and group torching is more than one tree often a patch of multiple trees torching.

Treatment - A term used to broadly refer to the management actions made to meet management objectives. It may include thinning, cutting of undesirable trees, prescribed fire, salvage, or any manipulation of the vegetative conditions. In addition, intentionally excluding a portion of a stand from harvest is a management action, or treatment.

Trees per Acre (TPA) – The number of trees on an acre of land.

U

Underburn - Using prescribed fire under the canopy of an existing stand of trees.

Undesirable Species - Any species of plant or animal which is NOT considered to be compatible with meeting management goals and objectives.

V

Vegetation Recovery- Period of time that allows for sufficient re-growth in harvested areas to make evidence of harvest activity largely unnoticeable to the casual observer.

W

Woody Debris - Dead pieces of woody vegetation such as stems, limbs, or leaves which are on a site.

Index